Stabilize/Improve Putnam Library B120

100% Bid Submittal

for the

DEPARTMENT OF VETERANS AFFAIRS MEDICAL CENTER
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RDC/JPA #22042.00

March 30, 2026

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	11-21
01 32 16.15	Project Schedules (Small Projects – Design/Bid/Build	11-21
01 33 23	Shop Drawings, Product Data, and Samples	02-23
01 35 26	Safety Requirements	10-22
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 74 19	Construction Waste Management	04-22
01 81 13	Sustainable Construction Requirements	10-17
	Terracon Geotechnical Engineering Report	
	DIVISION 02 – EXISTING CONDITIONS	
02 41 00	Demolition	08-17
02 82 11	Traditional Asbestos Abatement	01-21
02 82 13.13	Glovebag Asbestos Abatement	01-21
02 82 13.19	Asbestos Floor Tile and Mastic Abatement	01-21
02 82 13.31	Asbestos Transite Abatement	01-21
02 83 33.13	Lead-Based Paint Removal and Disposal	01-21
	Abatement Report Part 1	
	Abatement Report Part 2	
	Abatement Report Part 3	
	Lead Paint Report	
02 84 00	Animal Waste Remediation	03-25
	DIVISION 03 – CONCRETE	
03 30 53	Cast-in-Place Concrete	01-21
	DIVISION 04 – MASONRY	
04 01 00	Maintenance of Masonry	01-21
04 05 13	Masonry Mortaring	10-17
04 05 16	Masonry Grouting	01-21

SECTION NO.	DIVISION AND SECTION TITLES	DATE
04 20 00	Unit Masonry	08-17
	DIVISION 05 – METALS	
05 12 00	Structural Steel Framing	11-18
05 31 00	Steel Decking	01-21
05 50 00	Metal Fabrications	08-18
	DIVISION 06 – WOOD, PLASTICS AND COMPOSITES	
06 10 00	Rough Carpentry	10-17
06 20 00	Finish Carpentry	01-21
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION	
07 21 13	Thermal Insulation	01-21
07 21 23	Loose-Fill Insulation	01-21
07 22 00	Roof and Deck Insulation	01-21
07 31 13	Asphalt Shingles	02-21
07 40 00	Roofing and Siding Panels	01-21
07 54 23	Thermoplastic Polyolefin (TPO) Roofing	01-21
07 60 00	Flashing and Sheet Metal	01-21
07 71 00	Roof Specialties	01-21
07 81 00	Applied Fireproofing	07-23
07 81 23	Intumescent Fireproofing`	07-23
07 84 00	Firestopping	01-21
07 92 00	Joint Sealants	04-22
07 95 13	Expansion Joint Cover Assemblies	01-21
	DIVISION 08 - OPENINGS	
08 06 71	Door Hardware Schedule	
08 11 13	Hollow Metal Doors and Frames	01-21
08 14 00	Interior Wood Doors	01-21
08 39 53	Blast Resistant Doors and Frames	
08 44 13	Glazed Aluminum Curtain Walls	
08 45 23	Blast Rated Insulated Translucent Fiberglass Sandwich Panel Skylight System	
08 52 00	Aluminum Clad Wood Windows	
08 63 00	Metal-Framed Skylights	01-21
08 71 00	Door Hardware	05-22
08 80 00	Glazing	01-21
08 87 00	Security Glazing Films	
08 90 00	Louvers and Vents	01-21
	DIVISION 09 – FINISHES	
09 05 16	Subsurface Preparation for Floor Finishes	01-21
09 06 00	Schedule for Finishes	01-21

SECTION NO.	DIVISION AND SECTION TITLES	DATE
09 22 16	Non-Structural Metal Framing	06-18
09 23 00	Gypsum Plastering	01-21
09 29 00	Gypsum Board	04-20
09 30 13	Ceramic/Porcelain Tiling	01-21
09 64 00	Wood Flooring	
09 65 13	Resilient Base and Accessories	01-21
09 65 19	Resilient Tile Flooring	05-18
09 68 00	Carpeting	01-21
09 91 00	Painting	01-21
	DIVISION 10 – SPECIALTIES	
10 14 00	Signage	01-21
10 28 00	Toilet, Bath, and Laundry Accessories	01-21
10 44 13	Fire Extinguisher Cabinets	08-18
	DIVISION 12 – FURNISHINGS	
12 24 00	Window Shades	08-17
12 36 00	Countertops	12-18
	DIVISION 14– CONVEYING EQUIPEMENT	
14 24 00	New Hydraulic Elevator	04-24
	DIVISION 21- FIRE SUPPRESSION	
21 13 16	Dry-Pipe Sprinkler Systems	06-15
	DIVISION 22 – PLUMBING	
22 05 11	Common Work Results for Plumbing	01-23
22 05 12	General Motor Requirements for Plumbing Equipment	09-20
22 05 19	Meters and Gauges for Plumbing Piping	09-20
22 05 23	General-Duty Valves for Plumbing Piping	09-20
22 07 11	Plumbing Insulation	09-19
22 11 00	Facility Water Distribution	05-21
22 13 00	Facility Sanitary and Vent Piping	09-20
22 14 29	Sump Pumps	09-15
22 33 00	Electric Domestic Water Heaters	09-20
22 40 00	Plumbing Fixtures	12-22
	DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)	
23 05 11	Common Work Results for HVAC	04-22
23 05 12	General Motor Requirements for HVAC and Steam Generation Equipment	02-20
23 05 41	Noise and Vibration Control for HVAC Piping and Equipment	02-20
23 05 93	Testing, Adjusting, and Balancing for HVAC	02-20

SECTION NO.	DIVISION AND SECTION TITLES	DATE
23 07 11	HVAC and Boiler Plant Insulation	02-20
23 09 23	Direct-Digital Control System for HVAC	09-11
23 21 13	Hydronic Piping	02-20
23 21 23	Hydronic Pumps	02-20
23 22 13	Steam and Condensate Heating Piping	10-22
23 25 00	HVAC Water Treatment	02-20
23 31 00	HVAC Ducts and Casings	02-20
23 34 00	HVAC Fans	03-23
23 37 00	Air Outlets and Inlets	02-20
23 40 00	HVAC Air Cleaning Devices	03-20
23 64 00	Packaged Water Chillers	03-20
23 72 00	Air-to-Air Energy Recovery Equipment	03-20
23 73 00	Indoor Central Station Air Handling Units	03-23
23 82 00	Convection Heating and Cooling Units	03-20
23 82 16	Air Coils	03-20
	DIVISION 26 – ELECTRICAL	
26 05 11	Requirements for Electrical Installations	11-22
26 05 13	Medium-Voltage Cables	11-22
26 05 19	Low-Voltage Electrical Power Conductors and Cables	11-22
26 05 26	Grounding and Bonding for Electrical Systems	11-22
26 05 33	Raceway and Boxes for Electrical Systems	11-22
26 05 41	Underground Electrical Construction	11-22
26 05 73	Overcurrent Protective Device Coordination Study	11-22
26 09 23	Lighting Controls	11-22
26 12 19	Pad-Mounted, Liquid-Filled, Medium-Voltage Transformers	11-22
26 24 16	Panelboards	11-22
26 27 26	Wiring Devices	11-22
26 29 11	Motor Controllers	11-22
26 29 21	Enclosed Switches and Circuit Breakers	11-22
26 41 00	Facility Lightning Protection	11-22
26 43 13	Surge Protective Devices	11-22
26 51 00	Interior Lighting	11-22
26 56 00	Exterior Lighting	11-22
	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	Raceways and Boxes for Communications Systems	10-18
27 05 53	Identification for Communications Systems	12-22
27 10 00	Control, Communication and Signal Wiring	06-15
27 13 13	Communications Copper Backbone Cabling	12-22
27 15 00	Communications Structured Cabling	01-16
27 15 13	Communications Copper Horizontal Cabling	12-22
27 16 19	Communications Patch Cords, Station Cords and Cross Connect Wire	12-22

SECTION NO.	DIVISION AND SECTION TITLES	DATE
	DIVISION 28 – ELECTRONIC SAFETY AND SECURITY	
28 31 00	Fire Detection and Alarm	10-11
	DIVISION 31, DIVISION 32, DIVISION 33	
31 20 00	Earthwork	07-16
32 05 23	Cement and Concrete for Exterior Improvements	08-24
33 30 00	Sanitary Sewer Utilities	08-24
33 40 00	Storm Sewer Utilities	08-24

SECTION 00 01 15
LIST OF DRAWING SHEETS

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

Drawing No.	Title
G001	COVER SHEET
C100	GENERAL NOTES & DETAILS
C200	SURVEY BASEMAP
C300	DEMOLITION PLAN
C400	LOCATION PLAN
C500	UTILITY PLAN & PROFILES
C600	GRADING PLAN
C700	EROSION CONTROL NOTES
C701	EROSION CONTROL DETAILS
G100	CODE DATA
A000	EXISTING PLAN – BASEMENT
A001	EXISTING PLAN – FIRST FLOOR
A002	EXISTING PLAN – SECOND FLOOR
A003	EXISTING PLAN – THIRD FLOOR
A004	EXISTING PLAN – ATTIC
AD101	DEMOLITION PLANS
AD102	DEMOLITION PLANS
AD103	DEMOLITION REFLECTED CEILING PLANS
AD104	DEMOLITION EXTERIOR ELEVATIONS
A101	NEW WORK PLANS
A102	NEW WORK PLANS
A121	REFLECTED CEILING PLANS
A201	EXTERIOR ELEVATIONS
A301	BUILDING SECTIONS
A401	INTERIOR ELEVATIONS – RESTROOM
A402	INTERIOR ELEVATIONS – FIRST FLOOR
A403	INTERIOR ELEVATIONS – SECOND FLOOR
A404	INTERIOR ELEVATIONS – THIRD FLOOR
A501	ELEVATOR & MACHINE ROOM
A601	DOOR & WINDOW SCHEDULES, CURTAIN WALLS
A602	WALL TYPES & DETAILS
A603	WINDOW SECTIONS – EXISTING CONDITIONS

A604	WINDOW SECTIONS – NEW WORK
AF101	FINISH PLANS & FINISHES KEY
S001	GENERAL NOTES
S002	SCHEDULES AND LOADING DIAGRAMS
S003	SPECIAL INSPECTIONS & LOADING PLANS
S101	FOUNDATION PLAN
S111	FIRST FLOOR FRAMING PLAN
S121	SECOND FLOOR FRAMING PLAN
S131	THIRD FLOOR FRAMING PLAN
S141	ATTIC FRAMING PLAN
S151	ENLARGED PLANS AND DETAILS
S181	ELEVATIONS AND DETAILS
S201	FOUNDATION DETAILS & SECTIONS
S301	FLOOR FRAMING DETAILS & SECTIONS
S401	STEEL DETAILS, SECTIONS & SCHEDULES
F001	ABBREVIATIONS, LEGEND AND DESIGN NOTES
FX101	BASEMENT PLAN – FIRE SUPPRESSION
FX102	FRIST FLOOR PLAN – FIRE SUPPRESSION
FX103	SECOND FLOOR PLAN – FIRE SUPPRESSION
FX104	THIRD FLOOR PLAN – FIRE SUPPRESSION
FX105	ATTIC PLAN – FIRE SUPPRESSION
P001	ABBREVIATIONS, LEGEND AND GENERAL NOTES
PD100	DEMOLITION PLAN – BASEMENT
PD101	DEMOLITION PLAN – FIRST FLOOR
PD102	DEMOLITION PLAN – SECOND FLOOR
PD103	DEMOLITION PLAN – THIRD FLOOR
PP100	BASEMENT PLANS – NEW WORK
PP101	FIRST FLOOR PLANS – NEW WORK
PP102	SECOND FLOOR PLANS – NEW WORK
PP103	THIRD FLOOR PLANS – NEW WORK
P601	SCHEDULE. DETAILS & DIAGRAM
M001	ABBREVIATIONS, LEGEND AND GENERAL NOTES
MD100	DEMOLITION PLAN – BASEMENT
MD101	DEMOLITION PLAN – FIRST FLOOR
MD102	DEMOLITION PLAN – SECOND FLOOR
MD103	DEMOLITION PLAN – THIRD FLOOR
M100H	BASEMENT PLAN – DUCTWORK

M100P	BASEMENT PLAN – PIPING
M101H	FIRST FLOOR PLAN – DUCTWORK
M101P	FIRST FLOOR PLAN – PIPING
M102H	SECOND FLOOR PLAN – DUCTWORK
M102P	SECOND FLOOR PLAN – PIPING
M103H	THIRD FLOOR PLAN – DUCTWORK
M103P	THIRD FLOOR PLAN – PIPING
M104H	ATTIC PLAN – DUCTWORK
M104P	ATTIC PLAN – PIPING
M501	DETAILS
M502	DETAILS
M503	DETAILS
M504	ONE-LINE DIAGRAM
M601	SCHEDULES
M602	SCHEDULES
M603	SCHEDULES
M901	CONTROL DIAGRAM
M902	CONTROL DIAGRAM
M903	CONTROL DIAGRAM
E001	ABBREVIATIONS, LEGEND AND GENERAL NOTES
ED100	DEMOLITION PLAN – BASEMENT
ED101	DEMOLITION PLAN – FIRST FLOOR
ED102	DEMOLITION PLAN – SECOND FLOOR
ED103	DEMOLITION PLAN – THIRD FLOOR
EL100	BASEMENT PLAN – LIGHTING
EL101	FIRST FLOOR – LIGHTING
EL102	SECOND FLOOR – LIGHTING
EL103	THIRD FLOOR – LIGHTING
EL104	ATTIC FLOOR PLAN – LIGHTING
EP100	BASEMENT PLAN – POWER & SYSTEMS
EP101	FRIST FLOOR PLAN – POWER & SYSTEMS
EP102	SECOND FLOOR PLAN – POWER & SYSTEMS
EP103	THIRD FLOOR PLAN – POWER & SYSTEMS
EP104	ATTIC PLAN – POWER & SYSTEMS
E701	DIAGRAM – SINGLE LINE
T001	ABBREVIATIONS, LEGEND AND GENERAL NOTES
TD100	DEMOLITION PLAN – BASEMENT

TD101	DEMOLITION PLAN – FIRST FLOOR
TD102	DEMOLITION PLAN – SECOND FLOOR
TD103	DEMOLITION PLAN – THIRD FLOOR
TA100	BASEMENT PLAN – NEW WORK
TA101	FRIST FLOOR PLAN – NEW WORK
TA102	SECOND FLOOR PLAN – NEW WORK
TA103	THIRD FLOOR PLAN – NEW WORK
T201	ENLARGED PLAN – MTR 002
T501	DETAILS

- - - END - - -

SECTION 01 00 00
GENERAL REQUIREMENTS

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 Stabilize/Improve Putnam Library B120 as required by drawings and specifications.

B. Visits to the site by Bidders may be made only by appointment with the Medical Center COR.

C. Offices of RDC/JPA Architecture, 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. 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, GENERAL CONSTRUCTION: BASE BID: Work includes all general construction, alterations, roads, walks, grading, drainage, necessary removal of existing structures and construction, and certain other items described in the specifications and drawings for architectural, civil, structural, mechanical, electrical, plumbing, fire suppression, and telecommunications work.

B. ALTERNATE 1, DEDUCT: All work in BASE BID, except DELETE all labor and materials associated with the interior construction build out of the Third Floor Restrooms (rooms 302 & 303). This area will be existing to remain, and will receive the same finishes as the adjacent Stair (room 301). Windows in the impacted area will still follow the scope outlines in the BASE BID.

C. ALTERNATE 2, DEDUCT: All work in BASE BID, except DELETE all labor and materials associated with the interior construction build out of the Second Floor Restrooms (rooms 202 & 203). This area will be existing to remain, and will receive the same finishes as the adjacent Stair (room 201). Windows in the impacted area will still follow the scope outlines in the BASE BID.

D. ALTERNATE 3, DEDUCT: All work in BASE BID, except DELETE all labor and materials associated with the interior demolition of the Third Floor Hardwood Floors (found in rooms 301, 304, 305, 306, 307, 308 and 309). These floors will be existing to remain, and will be sanded down and refinished (stain color to match existing; verify with COR).

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 tool boxes and parked machines and take any emergency action.
   2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

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 5 permits shall be issued for General Contractor and its employees for parking in designated areas only. Contractor to coordinate with VA Medical Center Facility Manager.

1.6 OPERATIONS AND STORAGE AREAS (FAR 52.236-10)

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

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

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

cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

D. Working space and space available for storing materials shall be as 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.

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 work days. 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.

J. Building will be vacated by Government in accordance with above phasing beginning immediately after date of receipt of Notice to Proceed and turned over to Contractor.

K. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR.

L. When a building and/or construction site is turned over to Contractor, Contractor shall accept entire responsibility including upkeep and maintenance therefore:

1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.
2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Company (Department of Veterans Affairs or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.

M. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without a detailed work plan, the Medical Center Director’s prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY for additional requirements.

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

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

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

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

1.7 ALTERATIONS

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR and a representative of VA Supply Service, of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by all three, to the Contracting Officer. This report shall list by rooms and spaces:

1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of building.
2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
3. Shall note any discrepancies between drawings and existing conditions at site.
4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.

B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4).

C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:

1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workers in executing work of this contract.

D. Protection: Provide the following protective measures:

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

1.8 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:

1. Reserved items which are to remain property of the Government are identified by attached tags or noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COR.
2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center .

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.

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

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

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

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

1.10 RESTORATION

A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do

not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

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

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

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

1.11 PHYSICAL DATA – SOIL CONDITIONS

A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by Terracon.

(FAR 52.236-4)

B. Subsurface conditions have been developed by core borings and test pits. Logs of subsurface exploration are shown diagrammatically on drawings.

C. A copy of the soil report will be made available for inspection by bidders upon request to the Engineering Officer at the VA Medical Center, and shall be considered part of the contract documents.

D. Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site

1.12 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.

1.13 LAYOUT OF WORK

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

(FAR 52.236-17)

B. Establish and plainly mark 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, roads, parking lots, 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 also 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".

1.14 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.

1.15 WARRANTY MANAGEMENT

A. Warranty Management Plan: Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction at least 30 days before the planned pre-warranty conference, submit one set 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 work days and work continuously to completion or relief.
4. The “Construction Warranty Service Priority List” is as follows:
   a) Code 1-Life Safety Systems
      1) Fire suppression systems.
      2) Fire alarm system(s).
   b) Code 1-Air Conditioning Systems
      1) Air conditioning leak in part of the building, if causing damage.
      2) Air conditioning system not cooling properly.
   c) Code 1 Doors
      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

Warranty Tags
Telephone number
Warranty response time priority code

1.16 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.

1.17 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.

1.18 TEMPORARY USE OF NEW ELEVATORS

A. The Contractor and his personnel shall be permitted use of new elevator(s) subject to the following provisions:

1. Contractor shall make arrangements with the COR for use of elevator(s). Contractor may obtain elevator(s) for exclusive use.
2. Prior to the use of elevator(s), the Contractor shall have the elevator(s) inspected and accepted by an ASME accredited, certified elevator safety inspector. The acceptance report shall be submitted to the COR.
3. Submit to the COR the schedule and procedures for maintaining equipment. Indicate the day or days of the week and total hours required for maintenance. A report shall be submitted to the COR monthly indicating the type of maintenance conducted, hours used, and any repairs made to the elevator(s).
4. The Contractor shall be responsible for enforcing the maintenance procedures as per VA and manufacturers recommendations and requirements.
5. During temporary use of elevator(s) all repairs, equipment replacement and cost of maintenance shall be the responsibility of the Contractor.
6. Personnel for operating elevator(s) shall not be provided by the Department of Veterans Affairs.
7. Contractor shall cover and provide maximum protection of the entire elevator(s) installation.
8. The Contractor shall arrange for the elevator company to perform operation of the elevator(s) so that an ASME accredited, certified elevator safety inspector can evaluate the equipment. The Contractor shall be responsible for any costs of the elevator company.
9. All elevator(s) parts worn or damaged during temporary use shall be removed and replaced with new parts at the contractor's expense. This shall be determined by an ASME accredited certified elevator safety inspector after temporary use and before acceptance by the Government. Submit report to the COR for approval.
10. Elevator shall be tested as required by the testing section of the elevator(s) specifications before acceptance by the Department of Veterans Affairs. The Contractor shall be responsible for all cost associated with testing and inspection.

1.19 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.

1.20 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:

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.

1.21 NEW TELEPHONE EQUIPMENT

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

1.22 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 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.

D. Detail Drawing of construction sign showing required legend and other characteristics of sign is attached hereto and made a part of this specification.

1.25 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 attached hereto and is made a part of this specification.

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

1.26 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.

1.27 FINAL ELEVATION DIGITAL IMAGES

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

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

1.28 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.

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

PART 1- GENERAL

1.1 DESCRIPTION:

A. The Contractor shall develop a Critical Path Method (CPM) plan and schedule demonstrating fulfillment of the contract requirements (Project Schedule), and shall keep the Project Schedule up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) technique shall be utilized to satisfy both time and cost applications.

1.2 CONTRACTOR'S REPRESENTATIVE:

A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative (COR).

B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section.

C. The Contractor’s representative shall have the option of developing the project schedule within their organization or to engage the services of an outside consultant. If an outside scheduling consultant is utilized, Section 1.3 of this specification will apply.

1.3 CONTRACTOR'S CONSULTANT:

A. The Contractor shall submit a qualification proposal to the COR, within 10 days of bid acceptance. The qualification proposal shall include:

1. The name and address of the proposed consultant.
2. Information to show that the proposed consultant has the qualifications to meet the requirements specified in the preceding paragraph.
3. A representative sample of prior construction projects, which the proposed consultant has performed complete project scheduling services. These representative samples shall be of similar size and scope.

B. The Contracting Officer has the right to approve or disapprove the proposed consultant, and will notify the Contractor of the VA decision within seven calendar days from receipt of the qualification proposal. In case of disapproval, the Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The Contractor shall have their scheduling consultant approved prior to submitting any schedule for approval.

1.4 COMPUTER PRODUCED SCHEDULES

A. The contractor shall provide monthly, to the Department of Veterans Affairs (VA), all computer-produced time/cost schedules and reports generated from monthly project updates. This monthly computer service will include: three copies of up to five different reports (inclusive of all pages) available within the user defined reports of the scheduling software approved by the Contracting Officer; a hard copy listing of all project schedule changes, and associated data, made at the update and an electronic file of this data; and the resulting monthly updated schedule in PDM format. These must be submitted with and substantively support the contractor's monthly payment request and the signed look ahead report. The COR shall identify the five different report formats that the contractor shall provide.

B. The contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also responsible for the accurate and timely submittal of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.

C. The VA will report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports and associated diskette(s), when requested by the Contracting Officer's representative, to correct errors which affect the payment and schedule for the project.

1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL

A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the interim schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer's written approval before incorporating them into the network diagram. The Contracting Officer's separate approval of the Project Schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred**

during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents. These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

B. Within 30 calendar days after receipt of the complete project interim Project Schedule and the complete final Project Schedule, the Contracting Officer or his representative, will do one or both of the following:
   1. Notify the Contractor concerning his actions, opinions, and objections.
   2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three blue line copies of the revised Project Schedule, three copies of the revised computer-produced activity/event ID schedule and a revised electronic file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.

C. The approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.

D. The Complete Project Schedule shall contain approximately 100 work activities/events.

1.6 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. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. 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

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 including ASBESTOS ABATEMENT. The sum of each BID ITEM work shall equal the value of the bid item in the Contractors' bid.

1.7 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 COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.
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.

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.

C. 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 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 COR's approval of the Project Schedule.

D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

1.8 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. 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 an electronic file (s) of the resulting monthly updated schedule.

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.

1.9 PAYMENT AND PROGRESS REPORTING

A. Monthly schedule update meetings will be held on dates mutually agreed to by the COR and the Contractor. Contractor and their CPM consultant (if applicable) 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 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 Contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, 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 1.4 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 CPM schedule, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. 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.

1.10 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 of the following remedial actions:

1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
3. Reschedule the work in conformance with the specification requirements.

B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the COR 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.

1.11 CHANGES TO THE SCHEDULE

A. Within 30 calendar days after VA acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:
   1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
   2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
   3. The schedule does not represent the actual prosecution and progress of the project.
   4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.

B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.

C. Contracting Officer's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.

D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 – 4 (Changes, and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.

E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

1.12 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 justification, CPM data and supporting evidence as the 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.

B. Detailed submittal requirements are found in the technical sections of the contract specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the government.

C. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

1.2 DEFINITIONS

A. Preconstruction Submittals: Submittals which are required prior to issuing contract notice to proceed or starting construction. For example, Certificates of insurance; Surety bonds; Site-specific safety plan; Construction progress schedule; Schedule of values; Submittal register; List of proposed subcontractors.

B. Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.

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.

1.3 SUBMITTAL REGISTER

A. The submittal register will list items of equipment and materials for which he 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. Blank digital register provided for Contractor use below

ENG_FORM_4288-R.pdf

E. The Contractor shall update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by Contracting Officer.

F. The Contractor shall submit formal monthly updates to the submittal register in electronic format. Each monthly update shall document actual submission and approval dates for each submittal.

1.4 SUBMITTAL SCHEDULING

A. Submittals are to be scheduled, submitted, reviewed, and approved prior to the acquisition of the material or equipment.

B. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential resubmittal.

C. No delay costs or time extensions will be allowed for time lost in late submittals or resubmittals.

D. All submittals are required to be approved prior to the start of the specified work activity.

1.5 SUBMITTAL PREPARATION

A. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

B. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.

C. If available product data is incomplete, provide Contractor-prepared documentation to supplement product data and satisfy submittal requirements.

D. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain the excessive amount of irrelevant or unnecessary data will be returned without review.

E. Provide a transmittal form for each submittal with the following information:

1. Project title, location and number.
2. Construction contract number.
3. Date of the drawings and revisions.
4. Name, address, and telephone number of subcontractor, supplier, manufacturer, and any other subcontractor associated with the submittal.
5. List paragraph number of the specification section and sheet number of the contract drawings by which the submittal is required.
6. When a resubmission, add alphabetic suffix on submittal description. For example, submittal 18 would become 18A, to indicate resubmission.
7. Product identification and location in project.

F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting for VA review. Proposed deviations from the contract requirements are to be clearly identified. All deviations submitted must include a side by side comparison of item being proposed against item specified. Failure to point out deviations will result in the VA requiring removal and replacement of such work at the Contractor's expense.

G. Stamp, sign, and date each submittal transmittal form indicating action taken.

H. Stamp used by the Contractor on the submittal transmittal form to certify that the submittal meets contract requirements is to be similar to the following:

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_____________________________________________________________________
|                          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 Contracting Officer.

B. Compile the electronic submittal file as a single, complete document. Name the electronic submittal file specifically according to its contents.

C. Electronic files must be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied. If documents are scanned, Optical Character Resolution (OCR) routines are required.

D. E-mail electronic submittal documents smaller than 5MB in size to e-mail addresses as directed by the Contracting Officer.

E. Provide electronic documents over 5MB through an electronic FTP file sharing system. Confirm that the electronic FTP file sharing system can be accessed from the VA computer network. The Contractor is responsible for setting up, providing, and maintaining the electronic FTP file sharing system for the construction contract period of performance.

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

1.7 SAMPLES

A. Submit two sets of physical samples showing range of variation, for each required item.

B. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified.

C. When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

D. Before submitting samples, the Contractor is to ensure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

E. The VA reserves the right to disapprove any material or equipment which previously has proven unsatisfactory in service.

F. Physical samples supplied maybe requested back for use in the project after reviewed and approved.

1.8 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 Contracting Officer 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

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.

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

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

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

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

F. The VA will return submittals to the Contractor with the following notations:

1. "Approved": authorizes the Contractor to proceed with the work covered.
2. "Approved as noted": authorizes the Contractor to proceed with the work covered provided the Contractor incorporates the noted comments and makes the noted corrections.
3. "Disapproved, revise and resubmit": indicates noncompliance with the contract requirements or that submittal is incomplete. Resubmit with appropriate changes and corrections. No work shall proceed for this item until resubmittal is approved.
4. "Not reviewed": indicates submittal does not have evidence of being reviewed and approved by Contractor or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals after taking appropriate action.

1.11 APPROVED SUBMITTALS

A. The VA approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

B. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

C. After submittals have been approved, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

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

1.12 WITHHOLDING OF PAYMENT

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

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SECTION 01 35 26

SAFETY REQUIREMENTS

TABLE OF CONTENTS

1.1 APPLICABLE PUBLICATIONS: 3

1.2 DEFINITIONS: 4

1.3 SUBMITTAL REQUIRMENTS: 8

1.4 REGULATORY REQUIREMENTS: 9

1.5 ACCIDENT PREVENTION PLAN (APP): 9

1.6 ACTIVITY HAZARD ANALYSES (AHAs): 14

1.7 PRECONSTRUCTION SAFETY CONFERENCE: 15

1.8 SAFETY MEETINGS: 15

1.9 “SITE SAFETY AND HEALTH OFFICER” (SSHO) and “COMPETENT PERSON” (CP): 15

1.10 TRAINING: 17

1.11 INSPECTIONS: 18

1.12 MISHAPS, OSHA 300 LOGS, AND MAN-HOURS: 18

1.13 PERSONAL PROTECTIVE EQUIPMENT (PPE): 19

1.14 PRE-CONSTRUCTION RISK ASSESSMENT 20

1.15 DUST CONTROL 21

1.16 FIRE SAFETY 21

1.17 ELECTRICAL 23

1.18 FALL PROTECTION 24

1.19 SCAFFOLDS AND OTHER WORK PLATFORMS 25

1.20 EXCAVATION AND TRENCHES 25

1.21 CRANES 27

1.22 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT) 28

1.23 CONFINED SPACE ENTRY **29**

1.24 WELDING AND CUTTING **29**

1.25 LADDERS **29**

1.26 FLOOR & WALL OPENINGS **30**

SECTION 01 35 26
SAFETY REQUIREMENTS

1.1 APPLICABLE PUBLICATIONS:

A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

B. American Society of Safety Professionals (ASSP):

A10.1-2011 .....Pre-Project & Pre-Task Safety and Health Planning

A10.34-2012 .....Protection of the Public on or Adjacent to Construction Sites

A10.38-2013 .....Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment American National Standard Construction and Demolition Operations

Z359.0-2012 .....Definitions and Nomenclature Used for Fall Protection and Fall Arrest

Z359.1-2016 .....The Fall Protection Code

C. American Society for Testing and Materials (ASTM):

E84-2013 .....Surface Burning Characteristics of Building Materials

D. The Facilities Guidelines Institute (FGI):

FGI Guidelines-2010Guidelines for Design and Construction of Healthcare Facilities

E. National Fire Protection Association (NFPA):

10-2018.....Standard for Portable Fire Extinguishers

30-2018.....Flammable and Combustible Liquids Code

51B-2019 .....Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2020.....National Electrical Code

70B-2019 .....Recommended Practice for Electrical Equipment Maintenance

70E-2018 .....Standard for Electrical Safety in the Workplace

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

703-2024.....Standard for Fire Retardant–Treated Wood and Fire-Retardant Coatings for Building Materials

F. The Joint Commission (TJC)

TJC Manual .....Comprehensive Accreditation and Certification Manual

G. U.S. Nuclear Regulatory Commission

10 CFR 20 .....Standards for Protection Against Radiation

H. U.S. Occupational Safety and Health Administration (OSHA):

29 CFR 1904 .....Reporting and Recording Injuries & Illnesses

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

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

CPL 2-0.124.....Multi-Employer Citation Policy

I. US Army Corps of Engineers Safety and Occupational Health (SOH) Requirements Publication No. EM 385-1-1, 2024 edition

1.2 DEFINITIONS:

A. Critical Lift. A lift with the hoisted load exceeding 75% of the crane's maximum capacity; lifts made out of the view of the operator (blind picks); lifts involving two or more cranes; personnel being hoisted; and special hazards such as lifts over occupied facilities, loads lifted close to power-lines, and lifts in high winds or where other adverse environmental conditions exist; and any lift which the crane operator believes is critical.

B. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).

C. Competent Person, Confined Space
The CP, Confined Space, is a person meeting the competent person requirements as defined EM 385-1-1 Appendix Q, with thorough knowledge of OSHA's Confined Space Standard, 29 CFR 1910.146, and designated in writing to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training,

knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

D. Competent Person, Cranes and Rigging.
The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures regarding such hazards.

E. Competent Person, Excavation/Trenching.
A CP, Excavation/Trenching, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and 29 CFR 1926, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program, who through training, knowledge and experience in excavation/trenching is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

F. Competent Person, Fall Protection
The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and in accordance with ASSE/SAFE Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

G. Competent Person, Scaffolding
The CP, Scaffolding is a person meeting the competent person requirements in EM 385-1-1 Appendix Q and designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the scaffolding program. The CP for Scaffolding has enough training, knowledge and experience in scaffolding to correctly identify, evaluate and address existing and potential hazards and has the authority to take prompt corrective measures with regard to these hazards. CP qualifications must be documented and include experience on the specific scaffolding systems/types being used, assessment of the base material that the scaffold will be erected upon, load calculations for materials and personnel,

and erection and dismantling. The CP for scaffolding must have a documented, minimum of 8-hours of scaffold training to include training on the specific type of scaffold being used (e.g. mast-climbing, adjustable, tubular frame), in accordance with EM 385-1-1 Section 22.B.02.

H. Competent Person (CP) Trainer
A competent person trainer as defined in EM 385-1-1 Appendix Q, who is qualified in the material presented, and who possesses a working knowledge of applicable technical regulations, standards, equipment and systems related to the subject matter on which they are training Competent Persons. A competent person trainer must be familiar with the typical hazards and the equipment used in the industry they are instructing. The training provided by the competent person trainer must be appropriate to that specific industry. The competent person trainer must evaluate the knowledge and skills of the competent persons as part of the training process.

I. High Risk Activities
High Risk Activities are activities that involve work at heights, crane and rigging, excavations and trenching, scaffolding, electrical work, and confined space entry.

J. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

K. Qualified Person, Fall Protection (QP for FP)
A QP for FP is a person meeting the requirements of EM 385-1-1 Appendix Q, and ASSE/SAFE Z359.0, with a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, and evaluating and specifying fall protection and rescue systems.

L. USACE Property and Equipment
Interpret "USACE" property and equipment specified in USACE EM 385-1-1 as Government property and equipment.

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

N. Mishap: Mishap in this specification is defined according to the EM 385-1-1. A mishap is any unplanned, undesired event that occurs during the course of work being performed. This includes accidents, incidents, and near misses.

O. Mishap Criticality Categories

1. No impact/Near-Miss – near miss incidents that shall be investigated and reported to the VA within 24 hours.

2. Minor incident/impact – incidents that require first aid or result in minor equipment damage (less than $5000). These incidents must be investigated and reported to the VA within 24 hours.

3. Moderate incident/impact – Any work-related injury or illness that results in any of the following. These incidents must be investigated and are required to be reported to the VA within 2 hours.

    a. Days away from work (any time lost after day of injury/illness onset);

    b. Restricted work;

    c. Transfer to another job;

    d. Medical treatment beyond first aid;

    e. Loss of consciousness;

    f. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (5) above or,

    g. any incident that leads to major equipment damage (greater than $5000).

4. Major incident/impact – Any mishap that leads to fatalities, hospitalizations, amputations, and losses of an eye as a result of contractors' activities. Or any incident which leads to major property damage (greater than $20,000) and/or may generate publicity or high visibility. These incidents must be investigated and are required to be reported to the VA as soon as practical, but not later than 2 hours after the incident.

P. Load Handling Equipment (LHE)
LHE is a term used to describe cranes, hoists and all other hoisting equipment (hoisting equipment means equipment, including crane, derricks, hoists and power operated equipment used with rigging to raise, lower or horizontally move a load).

Q. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by physician or registered personnel.

1.3 SUBMITTAL REQUIRMENTS:

A. Government approval or concurrence is required for submittals with a "G" designation; submittals not having a "G" designation are submitted for information only.

B. Preconstruction Submittals

1. Accident Prevention Plan (APP); G

C. Reports

1. Monthly Contractor Health Safety and Environmental (HS&E) Performance Report; G
2. Notifications and Reports;
3. Mishap Reports;
4. Near-Miss Reports;
5. LHE Inspection Reports
6. Monthly Exposure Hour Reports;

D. Work Plans

1. Standard Lift Plan; G
2. Critical Lift Plan; G
3. Activity Hazard Analysis (AHA); G
4. Confined Space Entry Permit
5. Hot Work Permit
6. Radiography Operation Planning Work Sheet; G
7. Portable Gauge Operations Planning Worksheet; G

E. Certificates

1. Contractor Safety Self-Evaluation Checklist
2. Crane Operators/Riggers Certifications; G
3. Certificate of Compliance
4. Mobile Cranes Inspection Certificate
5. License Certificates

6. Machinery & Mechanized Equipment Certification Form

1.4 REGULATORY REQUIREMENTS:

A. In addition to the detailed requirements included in the provisions of this contract, comply with the most recent edition of USACE EM 385-1-1, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSP A10.34, and all applicable federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the COR, Regional Safety Engineer or Government Designated Authority.

1.5 ACCIDENT PREVENTION PLAN (APP):

A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that Mishap prevention responsibilities are being carried out.

B. The APP shall be prepared as follows:

1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract. Specifically articulating the safety requirements found within these VA contract safety specifications and the latest version of the United States Army Corps of Engineers – Safety and Occupational Health (SOH) Requirements - EM 385-1-1 Manual. Model language and format can be found in Appendix A of the EM 385-1-1 Manual

2. Address both the Prime Contractors and the subcontractors work operations.

3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.

4. Address all the elements/sub-elements and in order as follows:

   a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:

      1) 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, COR or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).

   b. **BACKGROUND INFORMATION**. List the following:

      1) Contractor;

      2) Contract number;

      3) Project name;

      4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).

   c. **STATEMENT OF SAFETY AND HEALTH POLICY**. Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided. The Statement of Safety and Health Policy must be signed by a company executive.

   d. **RESPONSIBILITIES AND LINES OF AUTHORITIES**. Provide the following:

      1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;

      2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.

      3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA or EM 385-1-1 Competent/Qualified Person(s) requirements must be attached.;

4) Requirements that no work shall be performed unless a designated competent person is present on the job site;

5) Requirements for pre-task Activity Hazard Analysis (AHAs);

6) Lines of authority;

7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

e. **SUBCONTRACTORS AND SUPPLIERS.** If applicable, provide procedures for coordinating SOH activities with other employers on the job site:

1) Identification of subcontractors and suppliers (if known);

2) Safety responsibilities of subcontractors and suppliers.

f. **TRAINING.**

1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.

2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc.…) and any requirements for periodic retraining/recertification are required.

3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.

4) OSHA 10-hour Construction Outreach training within the past five years is required for all workers on site and the OSHA 30-hour Construction Outreach training within the past five years is required for Trade Competent Persons (CPs)

g. **SAFETY AND HEALTH INSPECTIONS.**

1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., “Site Safety and Health CP”), proof of inspector’s training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.

2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)

h. **MISHAP INVESTIGATION & REPORTING.**

1) The APP shall include identify person(s) responsible to provide the following to the COR:

1. Monthly HS&E Performance Report (Exposure Hours Data);
2. Mishap investigation reports;
3. Project site injury and illness logs;
4. Near-Miss reports;

i. **PLANS (PROGRAMS, PROCEDURES) REQUIRED.** Based on a risk assessment of contracted activities and on mandatory OSHA and/or EM 385-1-1 compliance programs, the Contractor shall address all applicable occupational, patient, and public safety risks in site-specific compliance and accident prevention plans. These Plans shall include but are not limited to procedures for addressing the risks associated with the following:

1) Emergency response;

2) Contingency for severe weather;

3) Fire Prevention;

4) Medical Support;

5) Posting of emergency telephone numbers;

6) Prevention of alcohol and drug abuse;

7) Site sanitation (housekeeping, drinking water, toilets);

8) Night operations and lighting;

9) Hazard communication program;

10) Welding/Cutting “Hot” work;

11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);

12) General Electrical Safety;

13) Hazardous energy control (LOTO);

14) Site-Specific Fall Protection & Prevention;

15) Excavation/trenching;

16) Asbestos abatement;

17) Lead abatement;

18) Crane Critical lift;

19) Respiratory protection;

20) Health hazard control program;

21) Radiation Safety Program;

22) Abrasive blasting;

23) Heat/Cold Stress Monitoring;

24) Crystalline Silica Monitoring (Assessment);

25) Demolition plan (to include engineering survey);

26) Formwork and shoring erection and removal;

27) Pre-Cast Concrete;

28) Public (Mandatory compliance with ANSI/ASSP A10.34-2012);

29) Sub-contractor or cross-trade coordination;

C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction safety conference for acceptance. Work cannot proceed without an accepted APP.

D. Once accepted by the Contracting Officer Representative, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer in accordance with FAR Clause 52.236-13, *Accident Prevention*, until the matter has been rectified.

E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the COR, Contracting Officer Representative or Government Designated Authority. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the COR Office and Contracting Officer within 2 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions to safeguard onsite personnel, visitors, the public and the environment.

1.6 ACTIVITY HAZARD ANALYSES (AHAS):

A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site)

B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.

C. Work shall not begin until the AHA for the work activity has been accepted by the COR, Contracting Officer Representative or Government Designated Authority and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA, EM 385-1-1, or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.

2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).

   a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.

   b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.

3. Submit AHAs to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be

used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

4. The AHA list will be reviewed periodically (at least weekly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the Contracting Officer Representative or Government Designated Authority for review for compliance.

1.7 PRECONSTRUCTION SAFETY CONFERENCE:

A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the pre-construction safety conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.

B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.

1.8 SAFETY MEETINGS:

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors on the project location. The SSHO, supervisors, foremen, or CDSOs must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

1.9 “SITE SAFETY AND HEALTH OFFICER” (SSHO) AND “COMPETENT PERSON” (CP):

A. The Prime Contractor shall provide a Safety oversight team that includes a minimum of one (1) person at each project site, for each shift, to function as the Site Safety and Health Officer

(SSHO). The Prime Contractor shall provide a minimum of one “Full-Time” SSHO at each project site, for each shift (with no other duties) that holds as current, a professional safety certification with at least 3 years of dedicated construction safety related experience. The SSHO shall ensure that the requirements of the VA and of 29 CFR 1926.16 are met for the project. The SSHO must be at the work site at all times, during construction activities, to implement and administer the Contractor's safety program and government-accepted Accident Prevention Plan. If the SSHO is off-site for a period longer than 8 hours, or one shift, and not exceeding 40 hours, or 5 shifts, a pre-approved Alternate Safety Officer shall be provided and shall fulfill the same roles and responsibilities as the primary SSHO. The Alternate Safety Officer shall have the required training, experience, and qualifications in accordance with EM 385-1-1 Section 01.A.17, and all associated sub-paragraphs. When the SSHO is temporarily (not to exceed 8 hours) off-site, a Designated Representative (DR) from the Prime Contractors’ staff, as identified in the AHA may be used in lieu of an Alternate Safety Officer and shall be on the project site, at all times, when work is being performed. Note that the DR is a collateral duty safety position, with safety duties in addition to their full-time occupation. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.

B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).

C. These Competent Persons can have collateral duties as the subcontractor’s superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations). However, the SSHO has be a separate qualified individual from the Prime Contractor’s Superintendent and/or Quality Control Manager with duties only as the SSHO

D. The SSHO or an equally qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: *Superintendence by the Contractor*. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.

E. The repeated presence of uncontrolled hazards during a contractor’s work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).

1.10 TRAINING:

A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project.

B. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety Outreach class within the past five (5) years and:

1. Seven (7) years of construction industry safety related experience.

2. OR have a safety and health degree from an accredited university or college and five (5) years of construction industry safety related experience

3. OR hold as current, a Certified Safety Professional (CSP) or a Construction Health and Safety Technician (CHST) certification and five (3) years of construction industry safety related experience.

C. The Alternate Safety Officer shall meet, at a minimum, the requirements of EM 385-1-1 Section 1 and have five (5) years of construction industry safety experience If the SSHO does not have a current certification, certification must be obtained within 90 days, maximum, of contract award.

D. All designated CPs shall have completed the OSHA 30-hour Construction Safety course and/or EM 385-1-1 40-hour training within the past 5 years. In addition, all CPs with high hazard work operations (such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations) shall have a specialized formal course in the hazard recognition and control associated with those high hazard work operations. Documented “repeat” deficiencies in the execution of safety requirements will require retaking the requisite formal course.

E. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course within the past 5 years and any necessary safety training to be able to identify hazards within their work environment.

F. Submit training records associated with the above training requirements to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction safety conference for acceptance.

G. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety

guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.

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

1.11 INSPECTIONS:

A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection with a written report of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.

B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) shall randomly conduct a monthly site safety inspection. The CSP or CSHT shall be one that is not a part of the immediate site project team. The individual can be a corporate safety professional or independently contracted who is not an immediate member of the construction project site team. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.

1. Results of the inspection will be documented with tracking of the identified hazards to abatement.

2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.

3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.

4. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative within one week of the onsite inspection.

1.12 MISHAPS, OSHA 300 LOGS, AND EXPOSURE-HOURS:

A. The prime contractor shall establish and maintain a Near-Miss and Mishap reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, and accidental property damage (both government and contractor) that occur on site. Notify and provide an initial report to the Contracting Officer Representative as soon as practical, but no more than two hours after any Moderate or Major Mishap, High Visibility Incidents, or any weight handling and hoisting equipment mishap. No Impact/Near-Miss and Minor Mishaps shall be reported within 24 hours or as soon as practical. Within the notification the sender shall

include contractor name; contract title; type of contract; name of activity, installation or location where mishap occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of mishap (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the Mishap site until the Contracting Officer Representative determines whether a government investigation will be conducted.

B. Conduct a mishap investigation for all Mishaps including mishaps resulting in at least $20,000 in damages without injury, to establish the root cause(s) of the mishap. The Mishap investigation shall include images, 5 whys, the injured person's firsthand account, any witness accounts, methods of procedures, related AHA to the task, and corrective action plan signed by the president, vice president, or appropriate corporate-level leadership identified in the company's org chart for the project. Additionally, complete the VA Form 2162 (or equivalent) and provide the report to the Contracting Officer Representative within 7 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.

C. A summation of all exposure-hours worked by the contractor and associated sub-contractors for each month will be reported to Contracting Officer Representative no later than the 10th day of the following month.

D. A summation of all Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative upon request.

1.13 PERSONAL PROTECTIVE EQUIPMENT (PPE):

A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.

B. Any PPE above and beyond the Mandatory PPE identified below and determined by the Contracting Officer or their Representative to be necessary in the performance of the Governments duties relative to this contract, shall be provided to the Government upon written notification by the Contracting Officer and at no additional expense to the Government. All PPE provided to the Government shall also be accompanied by any relevant or required training necessary to ensure its proper use.

C. Mandatory Minimum PPE includes:

1. Hard Hats – unless written authorization is given by the Contracting Officer Representative in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA and/or EM 385-1-1 regulations.

2. Safety glasses - unless written authorization is given by the Contracting Officer Representative in circumstances of no eye hazards, appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.

3. Appropriate Safety Shoes – based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by Contracting Officer Representative in circumstances of no foot hazards.

4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

5. High-visibility Safety Apparel – appropriate brightly colored clothing that feature some type of reflective material on them, such as safety vests, shall be worn by personnel or visitors on construction sites.

1.14 PRE-CONSTRUCTION RISK ASSESSMENT

A. Control of all construction-associated hazards that affect VA medical facilities, their occupants, services and mission-essential functions and capabilities is critical in all medical center facilities. VHA Pre-Construction Risk Assessments (PCRAs) for construction, renovation and maintenance projects are included with this contract solicitation with required mitigations of identified hazards. VHA-PCRAs will be re-validated and updated as needed based on but not limited to changes from original designs, affected individuals, areas/locations, scope, contractor means and methods, safety requirements, phasing, contractor competencies and capabilities.

B. Infection Prevention and Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. A detailed analysis of potential risks for infectious disease transmission affecting the care, treatment or services of patients or residents has been conducted. VHA Infection Control Risk Assessments (ICRAs) are included with this contract solicitation with required mitigation actions/activities. VHA-ICRAs will be re-validated and updated as needed based on changes in

original designs, affected individuals, area(s) or location(s), scope, contractor means and methods, infection prevention and control requirements, differing site conditions, phasing, contractor competencies and capabilities, and infectious disease outbreaks.

C. For work occurring at a VA medical facility, coordinate with the facility Safety Manager/Officer, as several aspects of this section directly relate to infection control risk assessments required in or adjacent to construction affecting occupied buildings accredited by The Joint Commission.

D. Products and Materials:

1. Sheet Plastic: Fire retardant polyethylene, 6-mil thickness meeting local fire codes

2. Barrier Doors: Self Closing solid core wood in steel frame, painted

3. Dust proof drywall

4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.

5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose

6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches

7. Disinfectant: EPA-registered, Hospital-approved disinfectant or equivalent product

8. Portable Ceiling Access Module

1.15 DUST CONTROL

A. Contractor shall verify that dust will not be introduced into the facility through intake vents or building openings. HEPA filtration on intake vents is required where dust may be introduced.

B. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary.

C. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

1.16 FIRE SAFETY

A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer Representative for review for

compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.

B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.

C. For work occurring at a VA medical facility, coordinate with the facility Safety Manager/Officer, as several aspects of this section directly relate to interim life safety measures required in or adjacent to construction affecting occupied buildings accredited by The Joint Commission.

D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).

E. Temporary 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.

J. Standpipes: Install and extend standpipes up with each floor in accordance with 29 CFR 1926 and NFPA 241. Do not charge wet standpipes subject to freezing until weather protected.

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 COR.

M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative.

N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Facility Safety Office. Obtain permits from COR at least 48 hours in advance.

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.

1.17 ELECTRICAL

A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J – General Environmental Controls, 29 CFR Part 1910 Subpart S – Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.

B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.

C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstance when achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards or is infeasible due to equipment design or operational limitations is energized work permitted. 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).

1.18 FALL PROTECTION

A. The fall protection (FP) threshold height requirement is 4ft for ALL WORK in government occupied sites, unless the OSHA 29 CFR 1926 or EM 385-1-1 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work. For work occurring at new "greenfield" sites or sites with 24/7 Contractor controlled 100% restricted access, the fall protection (FP) threshold height may be increased to 6ft unless the OSHA 29 CFR 1926 or EM 385-1-1 requirements are more stringent.

1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.

2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.

3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.

4. Fall protection while using a ladder will be governed by the more stringent of OSHA and EM 385-1-1 requirements.

1.19 SCAFFOLDS AND OTHER WORK PLATFORMS

A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.

B. The fall protection (FP) threshold height requirement is 4 ft as stated in Section 1.16.

C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.

1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.

2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.

3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.

4. Emergency descent devices shall not be used as working platforms.

D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:

1. The Competent Person’s name and signature;

2. Dates of initial and last inspections.

E. Mast Climbing work platforms: When access ladders, including masts designed as ladders, exceed 20 ft (6 m) in height, positive fall protection shall be used.

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

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

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 penetrometer will be utilized in determination of the unconfined compression strength of the soil for comparison against OSHA table (Less than 0.5 Tons/FT2 – Type C, 0.5 Tons/FT2 to 1.5 Tons/FT2 – Type B, greater than 1.5 Tons/FT2 – Type A without condition to reduce to Type B).

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.

1.21 CRANES

A. All crane work shall comply with 29 CFR 1926 Subpart CC and EM 385-1-1.

B. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no “Phase In” date.

C. A detailed lift plan for all lifts shall be submitted to the COR, COR and/or other Government Designated Authority 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing and all other elements of a critical lift plan where the lift meets the definition of a critical lift. Critical lifts require a more comprehensive lift plan to minimize the potential of crane failure and/or catastrophic loss. The plan must be reviewed and accepted by the General Contractor before being submitted to the VA for review. The lift will not be allowed to proceed without prior acceptance of this document by the COR.

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 or more floors are vacated under the lift affected area AND a Contractor provided engineering analysis, performed by a Professional Engineer, demonstrates that overhead protection provided by the roof and vacated floors is sufficient to protect against the potential loss of a load being lifted or a minimum of 300 psf of protection is provided, whichever is greater

b. OR Overhead protection is designed by a Professional Engineer and installed over the roof by the Contractor to protect the occupants below. The installed system shall be sufficient to protect against the potential loss of a load being lifted or a minimum of 300 psf of protection is provided, whichever is greater.

c. OR A formal request may be submitted to the Contracting Officer for documentation, if available, indicating the roof of the building has been previously designed and constructed using a reinforced concrete roof slab or other means to provide overhead protection from construction activities specifically associated with the vertical or horizontal expansion of the same building AND a Contractor provided engineering analysis, performed by a Professional Engineer, demonstrates that overhead protection provided by the roof is sufficient to protect against the potential loss of a load being lifted or a minimum of 300 psf of protection is provided, whichever is greater.

1.22 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.

1.23 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.

1.24 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 COR at least 48 hours in advance.

1.25 LADDERS

A. All Ladder use shall comply with 29 CFR 1926 Subpart X and EM 385-1-1.

B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.

C. Manufacturer safety labels shall be in place on ladders

D. Step Ladders shall not be used in the closed position

E. Top steps or cap of step ladders shall not be used as a step

F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.

1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.

2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.

G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

1.26 FLOOR & WALL OPENINGS

A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M and EM 385-1-1.

B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. Skylights located in floors or roofs are considered floor or roof hole/openings.

C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toe boards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.

1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.

2. Covers shall be secured when installed, clearly marked with the word “HOLE”, “COVER” or “Danger, Roof Opening-Do Not Remove” or color-coded or equivalent methods (e.g., red or orange “X”). Workers must be made aware of the meaning for color coding and equivalent methods.

3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.

4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.

5. Workers are prohibited from standing/walking on skylights.

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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 60 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 5 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 to the Contracting Officer or Authorized designee. be issued by the CQC System Manager. Furnish copies of these letters
4. Procedures for scheduling, reviewing, certifying, and managing submittals including those of subcontractors, designers of record, consultants, A/E’s offsite fabricators, suppliers and

purchasing agents. These procedures must be in accordance with Section 01 33 23 Shop Drawings, Product Data, and Samples.

5. Control, verification, and acceptance of testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer or Authorized designee are required to be used)
6. Procedures for tracking Preparatory, Initial, and Follow-Up control phases and control, verification, and acceptance tests including documentation.
7. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
8. Reporting procedures, including proposed reporting formats.
9. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of specifications can generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the Coordination meeting.
10. Coordinate schedule work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections and Schedule of Special Inspections. Where the applicable Code issue by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the CQC Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspection Plan requirements in the CQC Plan.

C. 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 5 business days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CC operations, design activities (if applicable), control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and Contracting Officer or Authorized designee and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION:

A. Personnel Requirements: The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, a Design Quality Manager (if applicable), and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The Safety and Health Manager shall satisfy the requirements of Specification 01 35 26 Safety Requirements and reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety and Health Manager will also serve as a member of the CQC Staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer or Authorized designee. Provide adequate office space, filing systems, and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawings submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Government.

B. CQC System Manager: Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC system Manager is required to be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of PM or SRE to determine qualifications based on project complexity at construction review and 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 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.
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 COR office at least 14 days prior to the Final Acceptance Inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date schedule for the Final Acceptance Inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with FAR Clause 52.246-12 titled "Inspection of Construction".

3.9 DOCUMENTATION

A. Quality Control Activities: Maintain current records providing factual evidence that required QC activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:
   1. The name and area of responsibility of the Contractor/Subcontractor
   2. Operating plant/equipment with hours worked, idle, or down for repair.
   3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
   4. Test and control activities performed with results and references to specification/drawing requirements. Identify the Control Phase (Preparatory, Initial, and/or Follow-Up). List deficiencies noted, along with corrective action.
   5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specification/drawing requirements.
   6. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
   7. Offsite surveillance activities, including actions taken.
   8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
   9. Instructions given/received and conflicts in plans and specifications.
   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.

--- END ---

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 Society for Testing and Materials (ASTM):

A370-12 ..... Standard Test Methods and Definitions for Mechanical Testing of Steel Products

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

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

F3125/F3125M-15.....Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

D. American Welding Society (AWS):

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

1.3 REQUIREMENTS:

A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COR to such failure.

C. Written Reports: Testing laboratory shall submit test reports to COR, Contractor, unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to COR immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:

1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the 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 part time observation of fill placement and compaction and field density testing in building areas and provide part 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 AASHTO T99/T180, ASTM D698 and/or ASTM D1557.
2. Make field density tests in accordance with the primary testing method following ASTM D6938 or AASHTO T310 wherever possible. Field density tests utilizing ASTM D1556, AASHTO T191, or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COR before the tests are conducted.

a. Building Slab Subgrade: At least one test of subgrade for every 2000 square feet of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 2000 square feet of overlaying building slab, but in no case fewer than three tests.
b. Foundation Wall Backfill: One test per 3100 feet of each layer of compacted fill but in no case fewer than two tests.
c. Pavement Subgrade: One test for each 400 square yards, but in no case fewer than two tests.
d. Curb, Gutter, and Sidewalk: One test for each 300 feet, but in no case fewer than two tests.
e. Trenches: One test at maximum 100 foot intervals per 4 foot of vertical lift and at changes in required density, but in no case fewer than two tests.
f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to COR. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.

C. Fill and Backfill Material Gradation: One test per 100 yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C136, ASTM D422, or ASTM D1140.
D. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
E. Testing Materials: Test suitability of on-site and off-site borrow as directed by COR.

3.2 LANDSCAPING:

A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
1. Test for organic material by using ASTM D2974.
2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.

B. Submit laboratory test report of topsoil to COR.

3.4 SITE WORK CONCRETE:

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

3.5 CONCRETE:

A. Batch Plant Inspection and Materials Testing:

1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COR.
2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COR.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.
4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:
1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor’s expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m^3 (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. COR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day’s pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m^3 (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m^3 (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.

7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.
10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
    a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
    b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
15. Observe preparations for placement of concrete:
    a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
    b. Inspect preparation of construction, expansion, and isolation joints.
16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:
    a. Monitor and record amount of water added at project site.
    b. Observe minimum and maximum mixing times.
18. Measure concrete flatwork for levelness and flatness as follows:
    a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.

b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.

c. Provide the Contractor and the COR with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.

19. Other inspections:

a. Grouting under base plates.

b. Grouting anchor bolts and reinforcing steel in hardened concrete.

C. Laboratory Tests of Field Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by COR. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.

2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.

3. Furnish certified compression test reports (duplicate) to COR. In test report, indicate the following information:

a. Cylinder identification number and date cast.

b. Specific location at which test samples were taken.

c. Type of concrete, slump, and percent air.

d. Compressive strength of concrete in MPa (psi).

e. Weight of lightweight structural concrete in kg/m^3 (pounds per cubic feet).

f. Weather conditions during placing.

g. Temperature of concrete in each test cylinder when test cylinder was molded.

h. Maximum and minimum ambient temperature during placing.

i. Ambient temperature when concrete sample in test cylinder was taken.

j. Date delivered to laboratory and date tested.

3.6 REINFORCEMENT:

A. Review mill test reports furnished by Contractor.

B. 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.

3.7 MASONRY:

A. Mortar Tests:
   1. Laboratory compressive strength test:
      a. Comply with ASTM C780.
      b. Obtain samples during or immediately after discharge from batch mixer.
      c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
      d. Test one sample at 7 days and 2 samples at 28 days.
   2. Two tests during first week of operation; one test per week after initial test until masonry completion.

B. Grout Tests:
   1. Laboratory compressive strength test:
      a. Comply with ASTM C1019.
      b. Test one sample at 7 days and 2 samples at 28 days.
      c. Perform test for each 230 m^2 (2500 square feet) of masonry.

C. Masonry Unit Tests:
   1. Laboratory Compressive Strength Test:
      a. Comply with ASTM C140.
      b. Test 3 samples for each 460 m^2 (5000 square feet) of wall area.

D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m^2 (5000 square feet) of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

3.8 STRUCTURAL STEEL:

A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.

B. Prefabrication Inspection:
   1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
   2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
   3. Approve welder qualifications by certification or retesting.
   4. Approve procedure for control of distortion and shrinkage stresses.
   5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.

C. Fabrication and Erection:
   1. Weld Inspection:
      a. Inspect welding equipment for capacity, maintenance and working condition.

b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.

c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.

d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.

e. Measure 25 percent of fillet welds.

f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:

1) 20 percent of all shear plate fillet welds at random, final pass only.

2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.

3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.

4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.

5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.

g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.

h. Verify that correction of rejected welds are made in accordance with AWS D1.1.

i. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.

2. Bolt Inspection:

a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM F3125 Bolts.

b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM F3125 Bolts. Inspect all bolts in connection when one or more are rejected.

c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM F3125 Bolts. Inspect all bolts in connection when one or more are rejected.

d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.

e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.

f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.

D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to COR.

3.9 STEEL DECKING:

A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.

B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."

C. Submit inspection reports, certification, and instances of noncompliance to COR.

3.10 SHEAR CONNECTOR STUDS:

A. Provide field inspection and testing services required by AWS D.1 to insure shear connector studs have been installed in accordance with contract documents.

B. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.

C. Submit inspection reports, certification, and instances of noncompliance to COR.

- - - E N D - - -

SECTION 01 45 35
SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This guide specification will be applicable to 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.

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 - 22 Minimum Design Loads for Buildings and Other Structures

C. International Code Council (ICC)

2. ICC IBC - (2021) 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. Prior to pouring elevator mat foundation
2. Prior to pouring elevator foundation walls
3. After each phase of floor framing demolition and before reframing is commenced.

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. 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).

I. 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.

J. 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.

K. 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 Structural Designated Systems
   a. See structural drawings.

L. 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. Special Inspections Project Manual;

3. Special Inspections Agency's Written Practices
4. NDT Procedures and Equipment' Calibration Records;
5. SD-06 Test Reports;
6. Special Inspections
7. Daily Reports;
8. Special Inspections; Biweekly Reports;
9. SD-07 Certificates;
10. Fabrication Plant
11. Certificate of Compliance;
12. Special Inspector Qualifications;
13. Qualification Records for NDT technicians;
14. SD-11 Closeout Submittals;
15. Interim Final Report of Special Inspections;
16. Comprehensive Final Report of Special Inspections;

M. Special Inspector Qualifications: Submit qualifications for each SI, ASI, and the SIOR from the following certifying associations: Associated Air Balance Council (AABC); American Concrete Institute (ACI); Association of the Wall and Ceiling Industry (AWCI); American Welding Society (AWS); Factory Mutual (FM); International Code Council (ICC); Nondestructive Testing (NDT); National Institute for Certification in Engineering Technologies (NICET); Precast/Prestressed Concrete Institute (PCI); Post-Tensioning Institute (PTI); Underwriters Laboratories (UL). Qualifications should be in accordance with the following minimums.

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	
Wood	ICC Commercial Building Inspector Certificate with one year of related experience, or ICC Residential Building Inspector with on year of experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	

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	
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.	
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.

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. 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.	

Inspector	Responsibility	Condition
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
	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.	Applicable when SIOR is not required

Inspector	Responsibility	Condition
	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.	
	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.

-- END --

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 COR 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 on the Environmental Protection Plan. 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 on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
8. Protect adjacent areas from despoilment by temporary excavations and embankments.
9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
11. Handle discarded materials other than those included in the solid waste category as directed by the COR.

C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement

management techniques to control water pollution by the listed construction activities that are included in this contract.

1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
3. Monitor water areas affected by construction.

D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.

E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of Ohio and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.

1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.

1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00p.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		
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 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.

B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.

C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:

D. Waste Management Plan development and implementation.

E. Techniques to minimize waste generation.

F. Sorting and separating of waste materials.

G. Salvage of existing materials and items for reuse or resale.

H. Recycling of materials that cannot be reused or sold.

I. At a minimum the following waste categories shall be diverted from landfills:

1. Soil.
2. Inerts (eg, concrete, masonry and asphalt).
3. Clean dimensional wood and palette wood.
4. Green waste (biodegradable landscaping materials).
5. Engineered wood products (plywood, particle board and I-joists, etc).
6. Metal products (eg, steel, wire, beverage containers, copper, etc).
7. Sheathings
8. Cardboard, paper and packaging.
9. Bitumen roofing materials.
10. Plastics (eg, ABS, PVC).
11. Carpet and/or pad.
12. Gypsum board.
13. Insulation.
14. Paint.
15. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

1. C. Lead Paint: Section 02 83 33.13, LEAD BASED PAINT REMOVAL AND DISPOSAL.
2. D. Division 1 Sustainability specifications

1.3 QUALITY ASSURANCE

A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
   1. Excess or unusable construction materials.
   2. Packaging used for construction products.
   3. Poor planning and/or layout.
   4. Construction error.
   5. Over ordering.
   6. Weather damage.
   7. Contamination.
   8. Mishandling.
   9. Breakage.

B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.

C. Contractor shall develop and implement procedures to recycle construction and demolition waste.

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

1.7 RECORDS

A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration.

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.

- - - E N D - - -

SECTION 01 81 13
SUSTAINABLE CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes general requirements and procedures to comply with federal mandates and U.S. Department of Veterans Affairs (VA) policies for sustainable construction.

B. The Design Professional has selected materials and utilized integrated design processes that achieve the Government's objectives. Contractor is responsible to maintain and support these objectives in developing means and methods for performing work and in proposing product substitutions or changes to specified processes. Obtain approval from Contracting Officer for all changes and substitutions to materials or processes. Proposed changes must meet, or exceed, materials or processes specified.

1.2 RELATED WORK

A. Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

B. Section 01 74 19 CONSTRUCTION WASTE MANANGEMENT.

1.3 DEFINITIONS

A. Recycled Content: Recycled content of materials is defined according to Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260). Recycled content value of a material assembly is determined by weight. Recycled fraction of assembly is multiplied by cost of assembly to determine recycled content value.

1. "Post-Consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
2. "Pre-Consumer" material is defined as material diverted from waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

B. Biobased Products: Biobased products are derived from plants and other renewable agricultural, marine, and forestry materials and provide an alternative to conventional petroleum derived products. Biobased products include diverse categories such as lubricants, cleaning products, inks, fertilizers, and bioplastics.

C. Low Pollutant-Emitting Materials: Materials and products which are minimally odorous, irritating, or harmful to comfort and well-being of installers and occupants.

D. Volatile Organic Compounds (VOC): Chemicals that are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects.

1.4 REFERENCE STANDARDS

A. Carpet and Rug Institute Green Label Plus program.

B. U.S. Department of Agriculture BioPreferred program (USDA BioPreferred).

C. U.S. Environmental Protection Agency Comprehensive Procurement Guidelines (CPG).

D. U.S. Environmental Protection Agency WaterSense Program (WaterSense).

E. U.S. Environmental Protection Agency ENERGY STAR Program (ENERGY STAR).

F. U. S. Department of Energy Federal Energy Management Program (FEMP).

G. Green Electronic Council EPEAT Program (EPEAT).

1.5 SUBMITTALS

A. All submittals to be provided by contractor to COR.

B. Sustainability Action Plan:

1. Submit documentation as required by this section; provide additional copies of typical submittals required under technical sections when sustainable construction requires copies of record submittals.
2. Within 30 days after Preconstruction Meeting provide a narrative plan for complying with requirements stipulated within this section.
3. Sustainability Action Plan must:
   a. Make reference to sustainable construction submittals defined by this section.
   b. Address all items listed under PERFORMANCE CRITERIA.
   c. Indicate individual(s) responsible for implementing the plan.

C. Low Pollutant-Emitting Materials Tracking Spreadsheet: Within 30 days after Preconstruction Meeting provide a preliminary Low Pollutant-Emitting Materials Tracking Spreadsheet. The Low Pollutant-Emitting Materials Tracking Spreadsheet must be an electronic file and include all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.

D. Construction Indoor Air Quality (IAQ) Management Plan:

1. Not more than 30 days after Preconstruction Meeting provide a Construction IAQ Management Plan as an electronic file including descriptions of the following:
   a. Instruction procedures for meeting or exceeding minimum requirements of ANSI/SMACNA 008-2008, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling.
   b. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage.
   c. Schedule of submission of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials.
   d. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille.

e. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit.

f. Instruction procedures and schedule for implementing building flush-out.

E. Product Submittals:

1. Recycled Content: Submit product data from manufacturer indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content (excluding MEP systems equipment and components).
2. Biobased Content: Submit product data for products to be installed or used which are included in any of the USDA BioPreferred program's product categories. Data to include percentage of biobased content and source of biobased material.
3. Low Pollutant-Emitting Materials: Submit product data confirming compliance with relevant requirements for all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.
4. For applicable products and equipment, submit product documentation confirming ENERGY STAR label, FEMP certification, WaterSense, and/or EPEAT certification.

F. Sustainable Construction Progress Reports: Concurrent with each Application for Payment, submit a Sustainable Construction Progress Report to confirm adherence with Sustainability Action Plan.

1. Include narratives of revised strategies for bringing work progress into compliance with plan and product submittal data.
2. Include updated and current Low Pollutant-Emitting Materials Tracking Spreadsheet.
3. Include construction waste tracking, in tons or cubic yards, including waste description, whether diverted or landfilled, hauler, and percent diverted for comingled quantities; and excluding land-clearing debris and soil. Provide haul receipts and documentation of diverted percentages for comingled wastes.

G. Closeout Submittals: Within 14 days after Substantial Completion provide the following:

1. Final version of Low Pollutant-Emitting Materials Tracking Spreadsheet.
2. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed air handling units are used during construction.
3. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for final filtration media in air handling units.
4. Minimum 18 construction photographs including six photographs taken on three different occasions during construction of ANSI/SMACNA 008-2008, Chapter 3 approaches employed, along with a brief description of each approach, documenting implementation of IAQ

management measures, such as protection of ducts and on-site stored or installed absorptive materials.

5. Flush-out Documentation:
   a. Product data for filtration media used during flush-out.
   b. Product data for filtration media installed immediately prior to occupancy.
   c. Signed statement describing building air flush-out procedures including dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.

1.6 QUALITY ASSURANCE

A. Preconstruction Meeting: After award of Contract and prior to commencement of Work, schedule and conduct meeting with COR/COR and Architect to discuss the Project Sustainable Action Plan content as it applies to submittals, project delivery, required Construction Indoor Air Quality (IAQ) Management Plan, and other Sustainable Construction Requirements. The purpose of this meeting is to develop a mutual understanding of the Sustainable Construction Requirements and coordination of contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.

B. Construction Job Conferences: Status of compliance with Sustainable Construction Requirements of these specifications will be an agenda item at regular job meetings conducted during the course of work at the site.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.

C. Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

D. Green Seal Standard GC-36, Commercial Adhesives, October 19, 2000.

E. South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.

F. South Coast Air Quality Management District (SCAQMD) Rule 1168, July 1, 2005 and rule amendment date of January 7, 2005.

G. Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition (ANSI/SMACNA 008-2008), Chapter 3.

H. California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, Emission Testing method for California Specification 01350 (CDPH Standard Method V1.1-2010).

I. Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260).

J. ASHRAE Standard 52.2-2007.

PART 2 – PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Construction waste diversion from landfill disposal must comprise at least 50 percent of total construction waste, excluding land clearing debris and soil. Alternative daily cover (ADC) does not qualify as material diverted from disposal.

B. Low Pollutant-Emitting Materials:

1. Adhesives, sealants and sealant primers applied on site within the weatherproofing membrane must comply with VOC limits of SCAQMD Rule 1168:

a. Flooring Adhesives and Sealants:

1) Indoor carpet adhesives: 50 g/L.
2) Wood Flooring Adhesive: 100 g/L.
3) Rubber Floor Adhesives: 60 g/L.
4) Subfloor Adhesives: 50 g/L.
5) Ceramic Tile Adhesives and Grout: 65 g/L.
6) Cove Base Adhesives: 50 g/L.
7) Multipurpose Construction Adhesives: 70 g/L.
8) Porous Material (Except Wood) Substrate: 50 g/L.
9) Wood Substrate: 30 g/L.
10) Architectural Non-Porous Sealant Primer: 250 g/L.
11) Architectural Porous Sealant Primer: 775 g/L.
12) Other Sealant Primer: 750 g/L.
13) Structural Wood Member Adhesive: 140 g/L.
14) Sheet-Applied Rubber Lining Operations: 850 g/L.
15) Top and Trim Adhesive: 250 g/L.
16) Architectural Sealant: 250 g/L.
17) Other Sealant: 420 g/L.

b. Non-Flooring Adhesives and Sealants:

1) Drywall and Panel Adhesives: 50 g/L.
2) Multipurpose Construction Adhesives: 70 g/L.
3) Structural Glazing Adhesives: 100 g/L.
4) Metal-to-Metal Substrate Adhesives: 30 g/L.
5) Plastic Foam Substrate Adhesive: 50 g/L.
6) Porous Material (Except Wood) Substrate Adhesive: 50 g/L.

7) Wood Substrate Adhesive: 30 g/L.
8) Fiberglass Substrate Adhesive: 80 g/L.
9) Architectural Non-Porous Sealant Primer: 250 g/L.
10) Architectural Porous Sealant Primer: 775 g/L.
11) Other Sealant Primer: 750 g/L.
12) PVC Welding Adhesives: 510 g/L.
13) CPVC Welding Adhesives: 490 g/L.
14) ABS Welding Adhesives: 325 g/L.
15) Plastic Cement Welding Adhesives: 250 g/L.
16) Adhesive Primer for Plastic: 550 g/L.
17) Contact Adhesive: 80 g/L.
18) Special Purpose Contact Adhesive: 250 g/L.
19) Structural Wood Member Adhesive: 140 g/L.
20) Sheet Applied Rubber Lining Operations: 850 g/L.
21) Top and Trim Adhesive: 250 g/L.
22) Architectural Sealants: 250 g/L.
23) Other Sealants: 420 g/L.

2. Aerosol adhesives applied on site within the weatherproofing membrane must comply with the following Green Seal GS-36.
   a. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent VOCs by weight.
   b. Aerosol Adhesive, General-Purpose Web Spray: 55 percent VOCs by weight.
   c. Special-Purpose Aerosol Adhesive (All Types): 70 percent VOCs by weight.
3. Paints and coatings applied on site within the weatherproofing membrane must comply with the following criteria:
   a. VOC content limits for paints and coatings established in Green Seal Standard GS-11.
   b. VOC content limit for anti-corrosive and anti-rust paints applied to interior ferrous metal substrates of 250 g/L established in Green Seal GC-03.
   c. Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements must not exceed VOC content limits established in SCAQMD Rule 1113.
   d. Comply with the following VOC content limits:
      1) Anti-Corrosive/Antirust Paints: 250 g/L.
      2) Clear Wood Finish, Lacquer: 550 g/L.
      3) Clear Wood Finish, Sanding Sealer: 350 g/L.
      4) Clear Wood Finish, Varnish: 350 g/L.
      5) Floor Coating: 100 g/L.
      6) Interior Flat Paint, Coating or Primer: 50 g/L.

7) Interior Non-Flat Paint, Coating or Primer: 150 g/L.
8) Sealers and Undercoaters: 200 g/L.
9) Shellac, Clear: 730 g/L.
10) Shellac, Pigmented: 550 g/L.
11) Stain: 250 g/L.
12) Clear Brushing Lacquer: 680 g/L.
13) Concrete Curing Compounds: 350 g/L.
14) Japans/Faux Finishing Coatings: 350 g/L.
15) Magnesite Cement Coatings: 450 g/L.
16) Pigmented Lacquer: 550 g/L.
17) Waterproofing Sealers: 250 g/L.
18) Wood Preservatives: 350 g/L.
19) Low-Solids Coatings: 120 g/L.

4. Carpet installed in building interior must comply with one of the following:
   a. Meet testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
   b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at the 14 day time point.
5. Each non-carpet flooring element installed in building interior which is not inherently non-emitting (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) must comply with one of the following:
   a. Meet requirements of the FloorScore standard as shown with testing by an independent third-party.
   b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at 14 day time point.
6. Composite wood and agrifiber products used within the weatherproofing membrane must contain no added urea-formaldehyde resins.
7. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde.

C. Recycled Content:
1. Any products being installed or used that are listed on EPA Comprehensive Procurement Guidelines designated product list must meet or exceed the EPA's recycled content recommendations. The EPA Comprehensive Procurement Guidelines categories include:
   a. Building insulation.
   b. Cement and concrete.
   c. Consolidated and reprocessed latex paint.

d. Floor tiles.

e. Flowable fill.

f. Nonpressure pipe.

g. Roofing materials.

h. Structural fiberboard.

i. Compost and fertilizer made from recovered organic materials.

j. Hydraulic mulch.

k. Plastic lumber landscaping timbers and posts.

D. Biobased Content:

1. Materials and equipment being installed or used that are listed on the USDA BioPreferred program product category list must meet or exceed USDA's minimum biobased content threshold. Refer to individual specification sections for detailed requirements applicable to that section.

a. USDA BioPreferred program categories include:

1) Adhesive and Mastic Removers.

2) Carpets.

3) Cleaners.

4) Composite Panels.

5) Corrosion Preventatives.

6) Erosion Control Materials.

7) Dust Suppressants.

8) Fertilizers.

9) Floor Cleaners and Protectors.

10) Floor Coverings (Non-Carpet).

11) Glass Cleaners.

12) Hydraulic Fluids.

13) Industrial Cleaners.

14) Interior Paints and Coatings.

15) Mulch and Compost Materials.

16) Multipurpose Cleaners.

17) Multipurpose Lubricants.

18) Packaging Films.

19) Paint Removers.

20) Plastic Insulating Foam.

21) Pneumatic Equipment Lubricants.

22) Roof Coatings.

23) Wastewater Systems Coatings.

24) Water Tank Coatings.
25) Wood and Concrete Sealers.
26) Wood and Concrete Stains.

E. Materials, products, and equipment being installed which fall into a category covered by the WaterSense program must be WaterSense-labeled or meet or exceed WaterSense program performance requirements, unless disallowed for infection control reasons.
1. WaterSense categories include:
a. Bathroom Faucets
b. Commercial Toilets
c. Irrigation Controllers
d. Pre-Rinse Spray Valves
e. Spray Sprinkler Bodies

F. Materials, products, and equipment being installed which fall into any of the following product categories must be Energy Star-labeled.
1. Applicable Energy Star product categories as of 09/14/2017 include:
a. Appliances:
1) Air Purifiers and Cleaners.
2) Dehumidifiers.
b. Electronics and Information Technology:
1) Audio/Video Equipment.
2) Data Center Storage.
3) Enterprise Servers.
4) Professional Displays.
5) Set-Top and Cable Boxes.
6) Uninterruptible Power Supplies.
c. Heating and Cooling Equipment:
1) Water Heaters.
2) Light Commercial Heating and Cooling Equipment.
d. Other:
1) Light Bulbs.
2) Light Fixtures.
3) Roof Products.
4) Water Coolers.
5) Windows, Doors, and Skylights.

G. Materials, products, and equipment being installed which fall into any of the following categories must be FEMP-designated. FEMP-designated product categories as of 09/14/2017 include:
1. Electric Chillers, Air-Cooled (Commercial).

2. Electric Chillers, Water-Cooled (Commercial).
3. Exterior Lighting.
4. Fluorescent Ballasts.
5. Fluorescent Lamps, General Service.
6. Industrial Lighting (High/Low Bay).
7. Light Emitting Diode (LED) Luminaires.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Construction Indoor Air Quality Management:

1. During construction, meet or exceed recommended control measures of ANSI/SMACNA 008-2008, Chapter 3.
2. Protect stored on-site and installed absorptive materials from moisture damage.
3. If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda). Replace all filtration media immediately prior to occupancy.
4. Perform building flush-out as follows:
   a. After construction ends, prior to occupancy and with interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 degrees Fahrenheit and a relative humidity no higher than 60 percent. OR
   b. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it must be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or design minimum outside air rate determined until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space. During each day of flush-out period, ventilation must begin a minimum of three hours prior to occupancy and continue during occupancy.

---END---

Dayton VAMC 5521-21-102 Stabilize/Improve Putnam Library B120

Geotechnical Engineering Report

Prepared for:

RDC/John Poe Architects
3131 Newmark Drive, Suite 200
Miamisburg, Ohio 45342

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June 18, 2024

RDC/John Poe Architects
3131 Newmark Drive, Suite 200
Miamisburg, Ohio 45342

Attn: Mike Duke
P: 800-362-1532
E: mduke@rdcjohnpoe.com

Re: Geotechnical Engineering Report
Dayton VAMC 5521-21-102 Stabilize/Improve Putnam Library B120
4100 W Third Street
Dayton, Montgomery County, Ohio
Terracon Project No. N1235156

Dear Mr. Duke:

We have completed the scope of Geotechnical Engineering services for the above-referenced project in general accordance with Terracon Proposal No. PN1235156 dated April 28, 2023, and authorized on May 7, 2024. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of shallow foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon

STATE OF OHIO
JEFFREY D. DUNLAP
E-63301
REGISTERED
PROFESSIONAL ENGINEER

Peter Odom, E.I.
Field Engineer

Jeffrey D. Dunlap, P.E.
Group Manager/Senior Associate

Table of Contents

Introduction 1
Project Description 1
Site Conditions 2
Geotechnical Characterization 3
Seismic Site Class 4
Geotechnical Overview 4
Earthwork 5
- Site Preparation 5
- Fill Material Types 6
- Fill Placement and Compaction Requirements 7
- Utility Trench Backfill 7
- Grading and Drainage 8
- Earthwork Construction Considerations 8
- Construction Observation and Testing 10

Shallow Foundations 10
- Design Parameters – Compressive Loads 10
- Foundation Construction Considerations 11

Floor Slabs 12
- Floor Slab Design Parameters 12
- Floor Slab Construction Considerations 13

Lateral Earth Pressures 14
- Design Parameters 14
- Subsurface Drainage for Below-Grade Walls 15

General Comments 16

Figures

GeoModel

Attachments

Exploration and Testing Procedures
Site Location and Exploration Plans
Exploration and Laboratory Results
Supporting Information

Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the terracon logo will bring you

back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the Putnam Library improvements to be located on the Dayton VA Medical Campus at 4100 W Third Street in Dayton, Montgomery County, Ohio. Our report is focused on the elevator addition to be located on the Norwest side of the existing Putnam Library building. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Seismic site classification per IBC
- Site preparation and earthwork
- Foundation design and construction
- Slab on grade design and construction
- Lateral earth pressures

The geotechnical engineering Scope of Services for this project included the advancement of two (2) test borings, laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and boring locations are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs and/or as separate graphs in the **Exploration Results** section.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	An email request for proposal was provided by RDC/JPA on 4/25/23. The request included conceptual plan drawings of the layout of the planned development. Elevator Drawing A501, prepared by RDC/John Poe Architects, schematic set and undated, provided on June 11, 2024.

Item	Description
Project Description	The project includes an elevator addition to the west side of the north wing of the existing Putnam Library (Building 120).
Proposed Structure	Structures associated with the project include a four-story elevator shaft addition (three stories and a basement), which will extend from the basement to the third story of the existing structure.
Top of Pad Elevation	The building addition will be supported on a concrete mat foundation and spread footers.
Maximum Loads	Maximum load estimates were provided by RDC/JPA Architecture: ▪ Dead Load: 82 kips ▪ Live Load: 10 kips ▪ Snow Load: 5 kips

Terracon should be notified if any of the above information is inconsistent with the planned construction, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	▪ The project is located at 4100 W Third Street in Dayton, Montgomery County, Ohio. ▪ Latitude/Longitude (approximate) 39.7429456, -84.2582448 ▪ See **Site Location**
Existing Improvements	Existing three-story library building with a basement or crawl space on large Veteran's Administration medical campus with paved areas for pedestrian use and grass-covered lawn areas and sparse trees.
Existing Topography	Site is relatively level with surface grades at approximately EL. 956 feet, MSL based on Montgomery County GIS Mapping. The site slopes gradually downwards to the north and east to approximately EL. 954, MSL.

Item	Description
Geology	According to USDA Soil survey maps, the surficial soils at the site are classified as Miamian-Urban Land Complex (MoB) consisting of soils formed in loess and the underlying glacial till. The bedrock is mapped as being of Silurian Age and belonging to the Clinton and Cataract Groups which consists of interbedded shale and limestone layers. Bedrock was encountered at a depth of approximately 11 feet below the ground surface in the recent borings.

Geotechnical Characterization

We have developed a general characterization of the subsurface conditions based on our review of the subsurface exploration, laboratory data, geologic setting, and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual boring logs. The individual logs can be found in the **Exploration Results** and the GeoModel can be found in the **Figures** attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Silty Clay	Silty Clay, with various sand and gravel, brown, stiff to very stiff
2	Lean Clay	Lean Clay, with limestone fragments, brown to olive gray, stiff to very stiff

The borings were observed while drilling and at the completion of drilling for the presence of groundwater. Groundwater was not observed while drilling or at the completion of drilling. Groundwater conditions may be different at the time of construction. Groundwater conditions may change because of seasonal variations in rainfall, runoff, and other conditions not apparent at the time of drilling. Long-term groundwater monitoring was outside the scope of services for this project.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil/bedrock properties observed at the site and as described on the exploration logs and results, our professional opinion is for that a **Seismic Site Classification of C** be considered for the project. Subsurface explorations at this site were extended to a maximum depth of 11.5 feet where refusal on bedrock was encountered. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Geotechnical Overview

Two (2) test borings were advanced during this investigation to a maximum depth of 11.5 feet below the ground surface. Each boring encountered auger refusal on bedrock.

The test borings first encountered a surficial layer of topsoil that ranged in thickness from 3 inches to 5 inches. Below the topsoil, the borings encountered a layer of stiff to very stiff silty clay (GeoModel Layer 1), which has been interpreted as glacial till, to depths ranging between 8.5 feet and 11 feet below the ground surface. This layer had N-values ranging between 5 and 16 blows per foot (bpf) with tested moisture contents ranging between 11.5% and 19.5%. The Atterberg limit tests performed on two selected samples indicated the soil samples had liquid limits between 21 and 22 with plastic limits of 15 for both samples.

Underlying the silty clay, Test Boring B-2 encountered a layer of very stiff lean clay with limestone fragments (GeoModel Layer 2) to a depth of 11.5 feet below the ground surface. This layer had an N-value of 16 bpf with a tested moisture content of 13.5%. This soil has been interpreted as either glacial till or possibly residual soil.

Both borings encountered auger refusal on bedrock at depths of 11 feet in Boring B-1 and 11.5 feet in Boring B-2. No samples were able to be obtained from the bedrock layer, but bedrock at this site is mapped as consisting of interbedded shale and limestone layers.

The elevator is expected to be supported on a mat foundation and the steel columns are expected to be supported on shallow spread footers. It is expected that the shallow foundations will be supported on very stiff silty clay or lean clay soils (GeoModel 1 and

2) or bedrock. The on-site soils at the proposed foundation elevations are overconsolidated and bearing the proposed footings on soil and bedrock should result in minimal differential settlement and is considered acceptable. The **Shallow Foundations** section of this report provides additional recommendations for mat foundations and spread footers.

The near-surface native silty clay soils (GeoModel Layer 1) could become unstable with typical earthwork and construction traffic, especially after precipitation events. The effective drainage should be completed early in the construction sequence and maintained after construction to avoid potential issues. If possible, grading should be performed during the warmer and drier times of the year (historically summer and early fall). If grading is performed during the winter months, an increased risk for possible undercutting and replacement of unstable subgrade will persist. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to be minimal, but will include excavations and possible engineered fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for concrete mat foundations.

Site Preparation

Prior to placing any new fill or cutting the site to grade, existing vegetation, topsoil, and root mats should be removed. Complete stripping of the topsoil should be performed in the proposed construction area.

Provided utility plans and private utility location indicated that some existing utilities are present within the area of the proposed building addition. Any existing utilities should be relocated outside of the proposed addition footprint . The existing abandoned utilities should be completely removed, and the resulting excavations be replaced with structural fill as recommended in this report. Alternatively, the excavations from the utility removal could be replaced with controlled density fill (flowable fill) up to proposed foundation or floor slab subgrade elevation.

If room allows any areas to receive new fill should be proofrolled with heavy rubber-tired construction equipment, such as a loaded dump truck. Any weak areas indicated during the proof roll should be undercut and replaced with new structural fill. If room does not allow for a proof roll, the area should be visually evaluated by a representative of the geotechnical engineer which should include hand auger probes and hand penetrometer readings or dynamic cone penetrometers, unless bedrock is exposed at the subgrade elevation.

Fill Material Types

Reuse of On-Site Soil: Excavated on-site soil may be reused as fill in utility trenches and grading outside of the mat area. Some moisture conditioning of on-site soil reused as structural fill should be anticipated. It is recommended that any fill below the mat foundation itself bear on structural fill consisting of well-graded granular soils such as ODOT #304. If trenches from utility removal are located below the building foundations, it is recommended that they be backfilled with flowable fill up to the design mat or building footing bearing elevations.

Material property requirements for on-site soil for use as trench backfill are noted in the table below:

Property	Structural Fill
Composition	Free of deleterious material
Maximum particle size	3 inches
Plasticity	Maximum plasticity index of 20
GeoModel Layer Expected to be Suitable[1]	1, 2

1. Based on subsurface exploration. Actual material suitability should be determined in the field at time of construction.

Imported Fill Materials: Imported fill materials should meet the following material property requirements. Regardless of its source, compacted fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade.

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Low Plasticity Cohesive (Trench Backfill and Areas beyond Mat Only)	CL	Liquid Limit less than 40, Plasticity index less than 20 Less than 25% retained on No. 200 sieve

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Granular	GW [2]	Less than 10% passing No. 200 sieve

1. Structural fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. Similar to ODOT #304 or crushed limestone aggregate or granular material such as sand, gravel, or crushed stone containing no more than 10% low-plasticity fines.

Fill Placement and Compaction Requirements

Structural fill should meet the following compaction requirements.

Item	Structural Fill
Maximum Lift Thickness	▪ 8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used ▪ 4 to 6 inches in loose thickness when hand-guided equipment (i.e., jumping jack or plate compactor) is used
Minimum Compaction Requirements [1,2]	▪ 98% of maximum dry density (ASTM D 698)
Water Content Range [1]	▪ Low plasticity cohesive: -2% to +3% of optimum ▪ Granular: -3% to +3% of optimum

1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).
2. If the granular material is a coarse sand or gravel, of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254).

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with public works specifications for the utility being supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where

subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from any existing foundations without an engineering review of shoring requirements and geotechnical observation during construction.

On-site materials are considered suitable for the backfill of utility and pipe trenches from 1 foot above the top of the pipe to the final ground surface in floor slab areas in the mechanical room and in areas outside the building addition, provided the material is free of organic matter and deleterious substances. Utility trenches below the proposed mat foundation supporting the elevator should be backfilled with flowable fill from the top of the granular fill surrounding the utility to the design bearing elevation of the mat foundation.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath the foundation, the backfill should satisfy the gradation and expansion index requirements of the engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

Grading and Drainage

All grades must provide effective drainage away from the foundation during and after construction and should be maintained throughout the life of the structure. Water retained next to the mat foundation can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential foundation movements and/or cracking.

The exposed ground should be sloped and maintained at a minimum of 5% away from the proposed addition at least 10 feet beyond the edge of the concrete. After construction and landscaping have been completed, final grades should be verified to document that effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Deeper basement excavations may require larger tracked excavators. If excavations for foundations or the basement excavation penetrates into the bedrock, larger tracked excavators and possible hoe rams may be

necessary. Care should be taken to not undermine the existing building foundations during the excavation for the new addition.

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of the mat foundation. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to foundation construction.

The groundwater table, particularly during the historically wetter winter and spring months, could affect undercuts and excavations, especially for removal and replacement of lower-strength soils or in the excavation area for the elevator and the mechanical room. A temporary dewatering system consisting of sumps with pumps may be necessary to achieve the recommended depth of undercuts depending on groundwater conditions at the time of construction. A permanent subsurface drain around the footings and mat foundation along the perimeter of the proposed addition should be included in the design.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Excavations or other activities resulting in ground disturbance **have the potential to affect adjoining structures**. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining structures.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation and topsoil), evaluation and remediation of subgrade materials, as well as proof rolling and mitigation of unsuitable areas delineated by the proof roll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content.

In areas of foundation excavations and the planned partial undercut area beneath the mat/pad foundation, the bearing subgrade should be evaluated by the Geotechnical Engineer including shear strength testing, 1-inch diameter hand-auger probes, etc. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1, 2]	3,000 psf – foundations bearing on very stiff lean clay soils (GeoModel Layer 1 or 2) or undisturbed intact bedrock
Modulus of Subgrade Reaction for Mat/Pad Foundations at Basement Level	40 psi/inch
Required Bearing Stratum [3]	Very Stiff Silty Clay or Lean Clay Soils (GeoModel Layers 1 and 2) or bedrock
Sliding Resistance [4]	0.35 ultimate coefficient of friction (GeoModel Layers 1 and 2)

Item	Description
Minimum Embedment below Finished Grade [5]	32 inches
Estimated Total Settlement from Structural Loads [2]	Less than about 1 inch at the Mechanical Room Level Less than about ½ inch at the Basement Level
Estimated Differential Settlement [2, 6]	About 1/2 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the foundation base elevation. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**. Additional geotechnical consultation will be necessary if higher loads are anticipated. Please note that the mechanical room footings will be adjacent to the existing basement and the elevator, and the footings will likely have to be lowered to match the adjacent footings to avoid adding additional loads to the existing basement footings and the elevator mat foundation.
3. Unsuitable or soft soils should be undercut and replaced per the recommendations presented in **Earthwork**.
4. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials.
5. Embedment necessary for the turned-down edges to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
6. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured across the proposed mat foundation. If differential settlement between the mechanical room and the elevator shaft are not acceptable, then a construction joint between these portions of the addition should be considered.

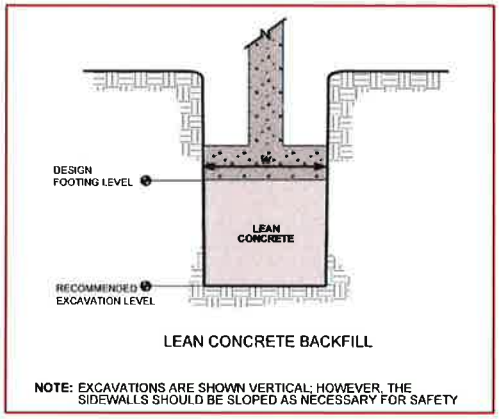
Foundation Construction Considerations

Where the addition footings are adjacent to the existing building footings, the new footings should match the bearing elevation of the existing foundations to avoid adding load to the existing foundations. This will lowering the mechanical room foundations. In addition, the footings in the mechanical room addition will need to be lowered to match the proposed elevator foundations to avoid adding additional load to the elevator addition foundations.

As noted in **Earthwork**, the foundation excavations should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the foundation excavations should be removed/reconditioned before foundation concrete is placed.

Sensitive soils exposed at the surface of foundation excavations may require surficial compaction with hand-held dynamic compaction equipment prior to placing structural fill. Should surficial compaction not be adequate, construction of a working surface consisting of either crushed stone or a lean concrete mud mat may be required prior to the construction of foundations.

If unsuitable bearing soils are observed at the base of the foundation excavations, the excavation should be extended deeper to suitable soils, and the foundation could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations to the design bearing elevation. The lean concrete replacement zone is illustrated on the sketch below.



Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support[1]	New structural fill or undisturbed, native cohesive soils Subgrade compacted to recommendations in **Earthwork** 4 inches of relatively free-draining granular material, as compared to the subgrade soil

Item	Description
Estimated Modulus of Subgrade Reaction [2]	100 pounds per square inch per inch (psi/in) for point loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

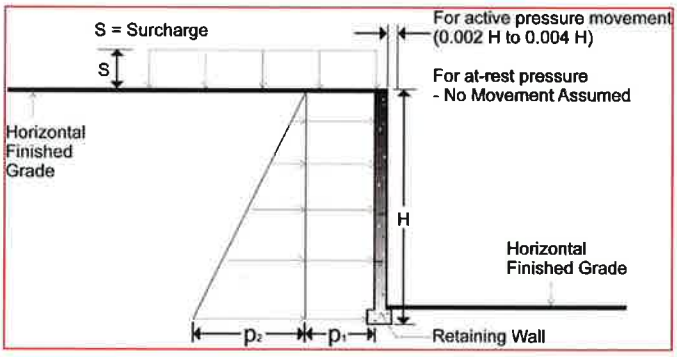
Finished subgrade, within and for at least 5 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Lateral Earth Pressures

Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction, and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes movement will occur at the top of the wall. The "at-rest" condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters

Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3] p_1 (psf)	Equivalent Fluid Pressures (psf) [2,4,5]
			Unsaturated [6]
Active (Ka)	Granular - 0.31	(0.31)S	(40)H
	Fine Grained - 0.41	(0.41)S	(50)H
At-Rest (Ko)	Granular - 0.47	(0.47)S	(55)H
	Fine Grained - 0.58	(0.58)S	(70)H

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance. Fat clay or other expansive soils should not be used as backfill behind the wall.
2. Uniform, horizontal backfill, compacted to at least 98% of the ASTM D698 maximum dry density, rendering maximum unit weight of 120 pcf.

Lateral Earth Pressure Design Parameters

Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3] p_1 (psf)	Equivalent Fluid Pressures (psf) [2,4,5]
			Unsaturated [6]

3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. No factor of safety is included in these values.
6. To achieve "Unsaturated" conditions, follow guidelines in **Subsurface Drainage for Below-Grade Walls** below. "Submerged" conditions are recommended when drainage behind walls is not incorporated into the design.

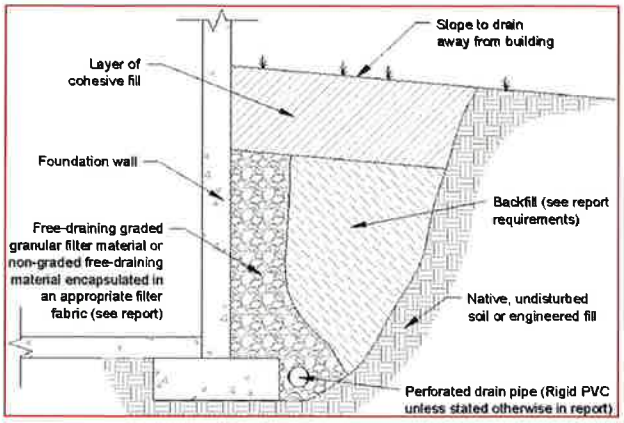
Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 degrees from vertical for the active case. The minimum granular backfill width for the at rest granular values to be valid is 50% of the retaining wall height.

Footings, floor slabs or other loads bearing on backfill behind walls may have a significant influence on the lateral earth pressure. Placing footings within wall backfill and in the zone of active soil influence on the wall should be avoided unless structural analyses indicate the wall can safely withstand the increased pressure.

The lateral earth pressure recommendations given in this section are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls (also termed MSE walls). Recommendations covering these types of wall systems are beyond the scope of services for this assignment. However, we would be pleased to develop a proposal for evaluation and design of such wall systems upon request.

Subsurface Drainage for Below-Grade Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5% passing the No. 200 sieve, such as No. 57 aggregate. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a prefabricated drainage structure may be used. A prefabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion and is fastened to the wall prior to placing backfill.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials, or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not

intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly affect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Figures

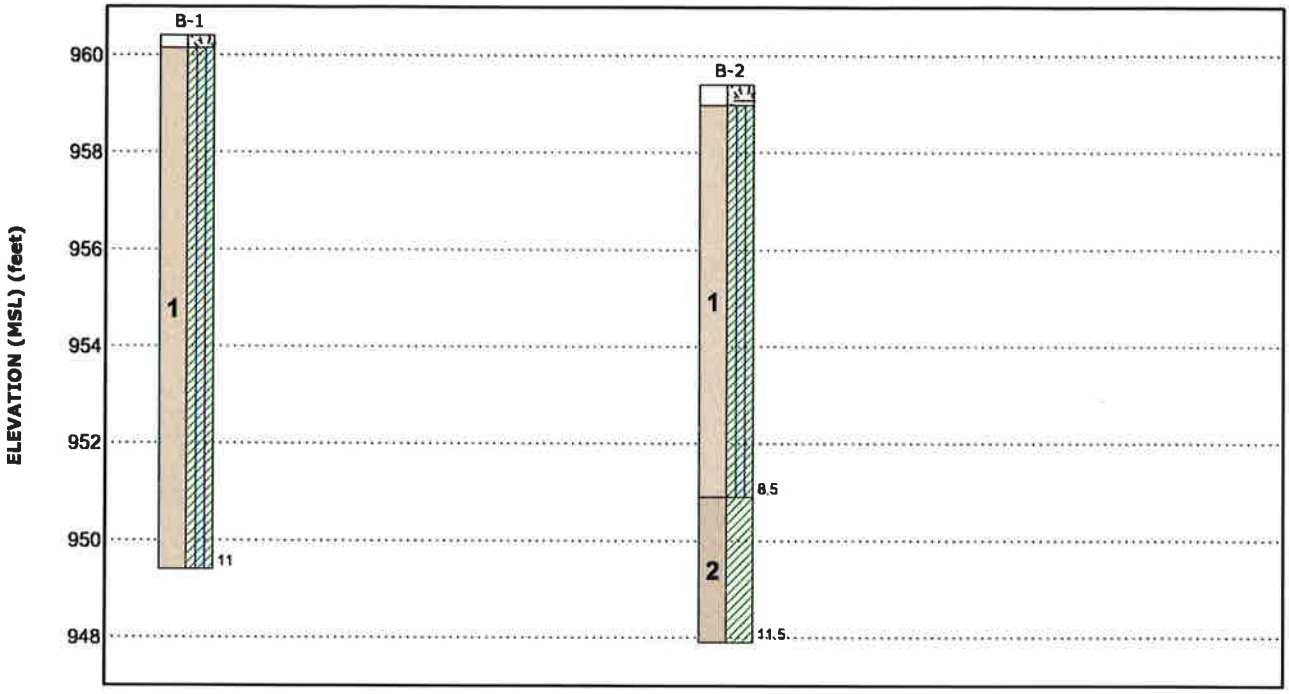
Contents:

GeoModel

Dayton VAMC Library Borings
4100 W Third St | Dayton, OH
Terracon Project No. N1235156

Terracon
611 Lunken Park Dr
Cincinnati, OH

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Silty Clay	Silty Clay, with various sand and gravel, brown, stiff to very stiff
2	Lean Clay	Lean Clay, with limestone fragments, brown to olive gray, very stiff

Legend	
Topsoil	Silty Clay
Lean Clay	

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
2	11 to 11.5	Building Addition Location

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±1 foot) and referencing existing site features. If a more precise boring layout or ground surface elevation are desired, we recommend the boring be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a track-mounted rotary drill rig using continuous-flight hollow-stem augers. Four samples were obtained in the upper 10 feet of the boring and at intervals of 5 feet thereafter. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths.

We also observed the boreholes while drilling and at the completion of drilling for the presence of groundwater. The groundwater levels are shown on the attached boring logs. For safety purposes, the boring was backfilled with auger cuttings after its completion.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. The field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. The final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and includes modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Atterberg Limits

The laboratory testing program included the examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location

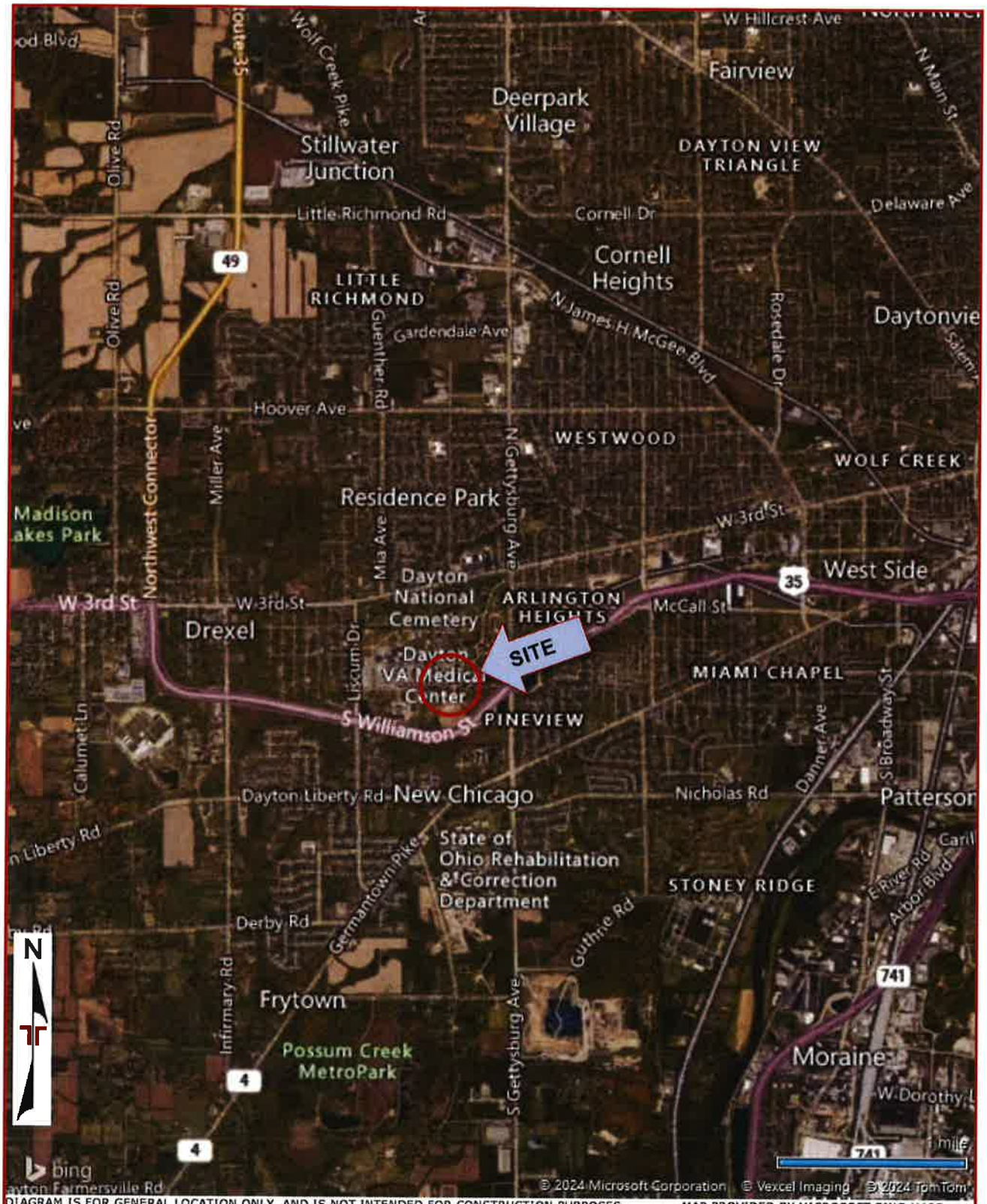


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

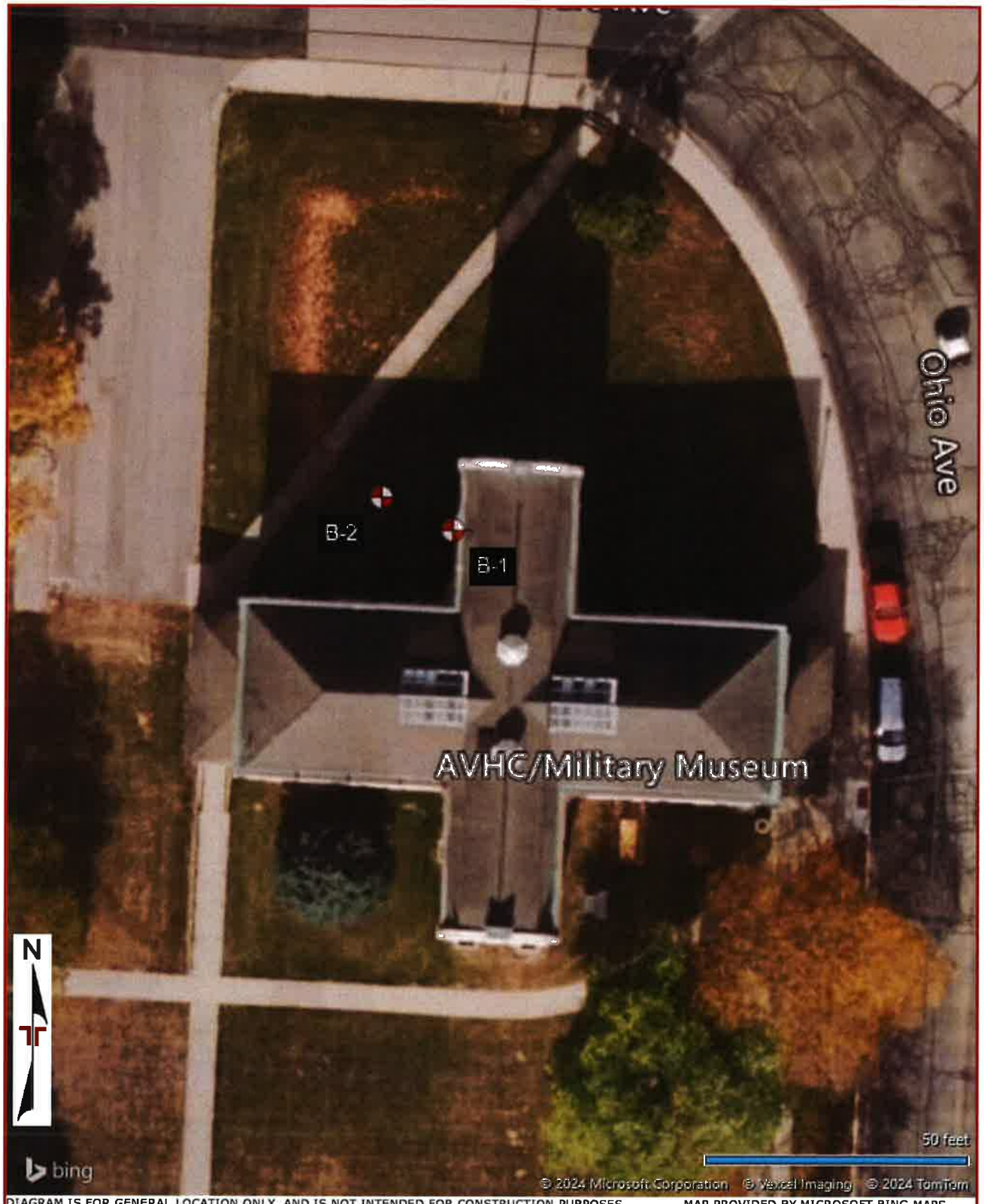


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (B-1 and B-2)
Atterberg Limits

Note: All attachments are one page unless noted above.

Dayton VAMC Library Borings
4100 W Third St | Dayton, OH
Terracon Project No. N1235156

Terracon
611 Lunken Park Dr
Cincinnati, OH

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 39.742948° Longitude: -84.258219°

Elevation.: 960.4 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Description	Elevation (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (%)	Field Test Results	HP (tsf)	Water Content (%)	Atterberg Limits LL-PL-PI
		0.3	**TOPSOIL (3 inches)**	960.15								
1			**SILTY CLAY (CL-ML)**, with gravel, trace sand, brown and light brown, stiff to very stiff									
								100	1-2-3 N=5	2.75 (HP)	11.7	
								67		2.5 (HP)	12.7	22-15-7
					5							
								100	4-4-5 N=9	2.0 (HP)	14.5	
								100	4-5-9 N=14	2.0 (HP)	11.5	
					10							
		11.0	***Auger Refusal on Shale and Limestone Bedrock at 11 Feet***	949.4				0	50/0"			

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were measured in the field using a Leica Zeno 20 GPS Unit.

Water Level Observations
Water not observed during drilling
Water not observed at completion of drilling

Drill Rig
GeoProbe #628

Hammer Type
Automatic

Driller
A. Moore

Notes
Drill Rig Energy Transfer Ratio = 92.7%

Advancement Method
2.25-inch Continuous-Flight Hollow-Stem Augers
2-inch Split-Barrel Sampler
3-inch Thin-Walled Tube

Abandonment Method
Boring backfilled with Auger Cuttings
Surface capped with concrete

Logged by
C. Butler

Boring Started
05-20-2024

Boring Completed
05-20-2024

Terracon
611 Lunken Park Dr
Cincinnati, OH

Boring Log No. B-2

Location: See Exploration Plan

Latitude: 39.742965° Longitude: -84.258267°

Elevation.: 959.4 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (%)	Field Test Results	HP (tsf)	Water Content (%)	Atterberg Limits LL-PL-PI
		0.4	**TOPSOIL (5 inches)** 958.98								
1			**SILTY CLAY (CL-ML)**, trace sand and gravel, brown with dark brown, very stiff			X	100	3-4-5 N=9	3.5 (HP)	19.5	
1						X	100	4-5-7 N=12	3.5 (HP)	12.8	21-15-6
				5							
1						X	67	7-7-9 N=16	2.5 (HP)	14.3	
		8.5	950.9								
2			**LEAN CLAY (CL)**, with limestone fragments, trace silt pockets, brown to olive gray, very stiff			X	67	7-7-9 N=16	3.5 (HP)	13.5	
				10							
		11.5	947.9								
			Auger Refusal on Shale and Limestone Bedrock at 11.5 Feet				0	50/0"			

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were measured in the field using a Leica Zeno 20 GPS Unit.

Water Level Observations
Water not observed during drilling

Water not observed at completion of drilling

Drill Rig
GeoProbe #628

Hammer Type
Automatic

Driller
A. Moore

Notes
Drill Rig Energy Transfer Ratio = 92.7%

Advancement Method
2.25-inch Continuous-Flight Hollow-Stem Augers
2-inch Split-Barrel Sampler

Abandonment Method
Boring backfilled with Auger Cuttings
Surface capped with concrete

Logged by
C. Butler

Boring Started
05-20-2024

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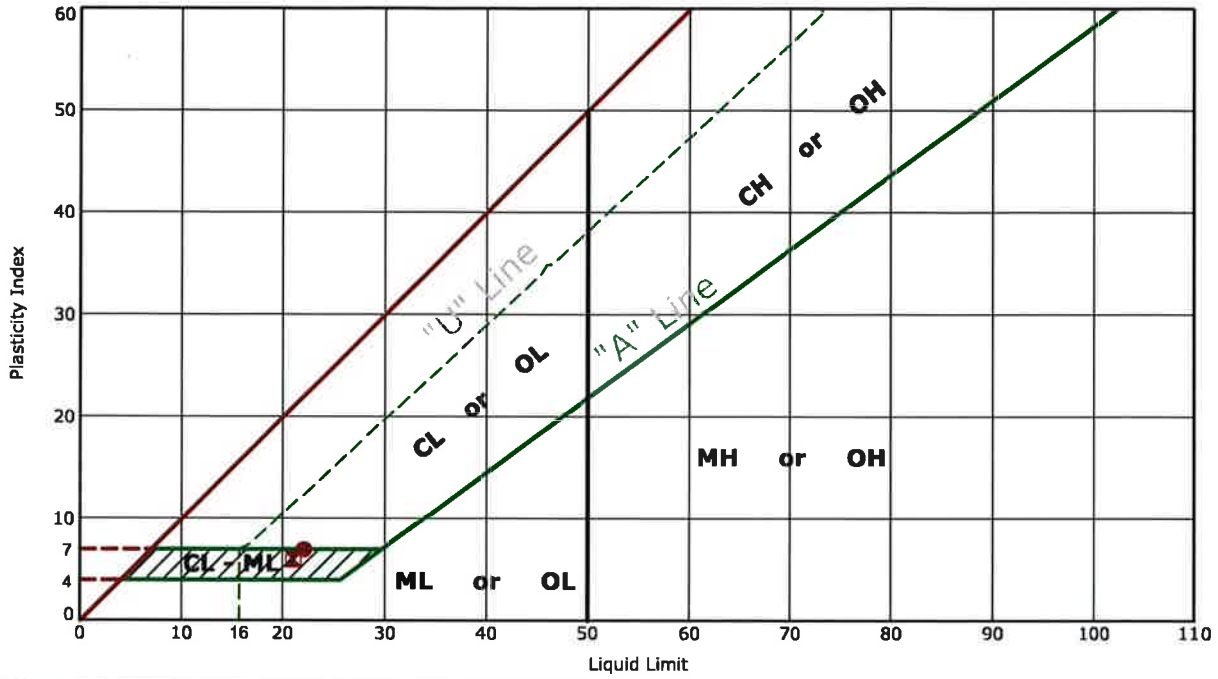
611 Lunken Park Dr
Cincinnati, OH

Atterberg Limit Results

ASTM D4318



	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	B-1	3 - 5	22	15	7		CL-ML	Silty Clay
⊠	B-2	3.5 - 5	21	15	6		CL-ML	Silty Clay

Supporting Information

Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above.

Terracon
611 Lunken Park Dr
Cincinnati, OH

General Notes

Sampling	Water Level	Field Tests
Shelby Tube Split Spoon	Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N — Standard Penetration Test Resistance (Blows/Ft.) (HP) — Hand Penetrometer (T) — Torvane (DCP) — Dynamic Cone Penetrometer UC — Unconfined Compressive Strength (PID) — Photo-Ionization Detector (OVA) — Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

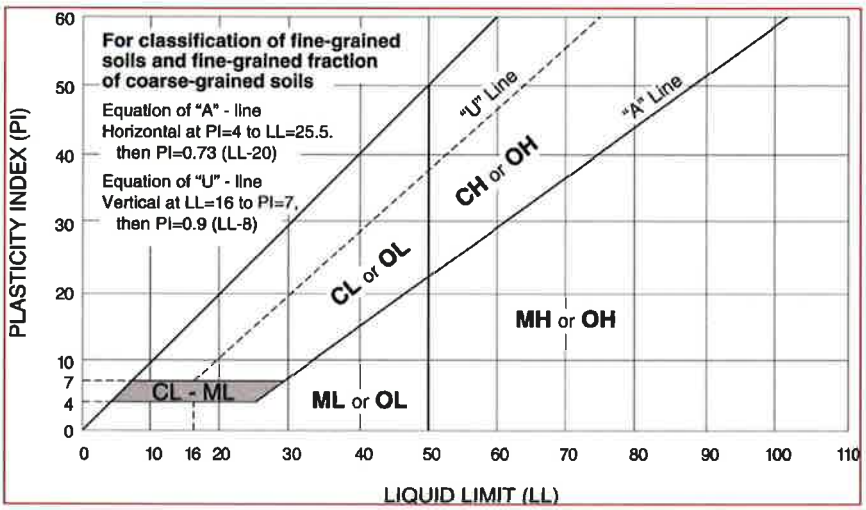
Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



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, EARTH MOVING.

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

C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.

D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.

E. Asbestos Removal: Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

F. Lead Paint: Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.

G. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

H. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.

I. Infectious Control: Section 01 35 26, SAFETY REQUIREMENTS.

1.3 PROTECTION:

A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.

C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.

F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
   1. No wall or part of wall shall be permitted to fall outwardly from structures.
   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 be hauled to VA specified disposal site. 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 - - -

SECTION 02 82 11
TRADITIONAL ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY OF THE WORK

A. Contract Documents and Related Requirements: Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show or describe the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Asbestos Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred due to such action are also the responsibility of the Asbestos Abatement Contractor.

B. Extent of Work:

1. Below is a brief description of the estimated quantities of asbestos-containing materials (ACM) to be abated. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy himself as the actual quantities to be abated. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.
2. Removal, clean-up, and disposal of the following asbestos-containing materials (ACM):

Material Description	Material Location(s)	Estimated Quantity
Exterior Textured Painted on Masonry of Building	Building Exterior Facades	15,000 Square Feet

3. The General Contractor, not the asbestos abatement contractor, shall retain the services of an independent third-party consultant appropriately experienced and trained/licensed to conduct the onsite abatement VPIH/CIH monitoring services for the duration of the abatement as outlined in this specification. The abatement contractor shall be responsible for their own CPIH/CIH services outline in this specification.

C. Related Work:
   1. Section 07 84 00, FIRESTOPPING
   2. Section 02 41 00, DEMOLITION
   3. Section 02 82 13.13, Glovebag Asbestos Abatement
   4. Section 02 82 13.19, Asbestos Floor Tile and Mastic Abatement
   5. Section 02 82 13.31, Asbestos Transite-Type Abatement
   6. Section 02 83 33.13, Lead-Based Paint Removal and Disposal
   7. Division 09, FINISHES
   8. Division 22, PLUMBING
   9. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
   10. Section 22 05 19, METERS AND GAUGES FOR PLUMBING PIPING
   11. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING
   12. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING
   13. Section 22 05 33, HEAT TRACING FOR PLUMBING PIPING
   14. Section 22 11 00, FACILITY WATER DISTRIBUTION
   15. Section 22 13 00, FACILITY SANITARY AND VENT PIPING SEWERAGE
   16. Section 23 05 11, COMMON WORK RESULTS FOR HVAC
   17. Section 22 13 23, SANITARY WASTE INTERCEPTORS
   18. Section 22 14 00, FACILITY STORM DRAINAGE
   19. Section 22 66 00, CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES
   20. Section 23 07 11, HVAC AND BOILER PLANT INSULATION
   21. Section 23 11 23, FACILITY NATURAL-GAS PIPING
   22. Section 23 21 13, HYDRONIC PIPING
   23. Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING
   24. Section 23 31 00, HVAC DUCTS AND CASINGS
   25. Section 23 37 00, AIR OUTLETS AND INLETS

D. Tasks:
   1. The work tasks are summarized briefly as follows:
      a. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, regulated area preparations, emergency procedures arrangements, and standard operating procedures for asbestos abatement work.
      b. Abatement activities including removal, encapsulation , enclosure, clean-up and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.
      c. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.

d. NOTE: The VPIH/CIH services shall be performed by an independent consultant hired by the GENERAL CONTRACTOR (NOT THE ABATEMENT CONTRACTOR) as further described in specification.

E. Contractors Use of Premises:

1. The Contractor and Contractor's personnel shall cooperate fully with the VA representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.
2. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedures. VA Design and Construction Procedures drawings of partially occupied buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building; and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA representative through the pre-abatement plan of action. The following limitations of use shall apply to existing facilities shown on drawings.

1.2 VARIATIONS IN QUANTITY

A. The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 10 percent) in quantities of ACM within the regulated area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered ACM and those prices shall be used for additional work required under the contractor.

1.3 STOP ASBESTOS REMOVAL

A. If the Contracting Officer; their field representative; the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal **Stop Asbestos Removal Order**, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed ACM. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as it is practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification,

regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor's competent person to the VA Contracting Office or field representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities if:

1. Airborne PCM analysis results equal to or greater than 0.01 f/cc above background levels inside the building but outside the regulated area;
2. breach or break in regulated area containment barrier(s);
3. less than –0.02-inch WCG pressure in the regulated area;
4. serious injury/death at the site;
5. fire/safety emergency at the site;
6. respiratory protection system failure;
7. power failure or loss or inadequate use of wetting agent;
8. any visible emissions observed outside the regulated area; or
9. failure to follow project specification requirements.

1.4 DEFINITIONS

A. General: Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents, but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

B. Glossary:

Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, encapsulation, enclosure, demolition, and renovation activities related to asbestos containing materials (ACM).

Adequately wet - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.

Aerosol - Solid or liquid particulate suspended in air.

Aggressive method - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.

Aggressive air sampling - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.

AHERA - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.

Aircell - Pipe or duct insulation made of corrugated cardboard which contains asbestos.

Air monitoring - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 3, Fifth Edition is used to determine the fiber levels in air. For personal samples, area air samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis, the NIOSH Method 7402 (Issue 2, Fourth Edition) can be used when it is necessary to confirm fibers counted by PCM as being asbestos. The AHERA TEM analysis may be used for background, area samples and clearance samples when required by this specification, or at the discretion of the VPIH/CIH as appropriate.

Air sample filter - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester (MCE) membrane for PCM (Phase Contrast Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.8-micron pore size) and MCE for TEM (Transmission Electron Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.45 micron pore size).

Amended water - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.

Asbestos - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.

Asbestos Hazard Abatement Plan (AHAP) - Asbestos work procedures required to be submitted by the contractor before work begins.

Asbestos-containing material (ACM) - Any material containing more than one percent of asbestos.

Asbestos contaminated elements (ACE) - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.

Asbestos-contaminated soil (ACS) – Soil found in the work area or in adjacent areas such as crawlspaces or pipe tunnels which is contaminated with asbestos-containing material debris and cannot be easily separated from the material.

Asbestos-containing waste (ACW) material - Asbestos-containing material or asbestos contaminated objects requiring disposal.

Asbestos Project Monitor – Some states require that any person conducting asbestos abatement air sampling, clearance inspections and clearance air sampling be licensed as an asbestos project monitor.

Asbestos waste decontamination facility - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of asbestos waste. Used as the exit for waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel.

Authorized person - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.

Authorized visitor - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA).

Barrier - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.

Containment Barrier - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.

Critical Barrier - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of 2-layers of 6-mil independently installed plastic sheeting (Polyethylene) secured in place at openings such as doors, windows, penetrations or any other opening into the regulated area.

Primary Barrier – Plastic barriers placed over critical barriers and exposed directly to abatement work or to secondary barrier.

Secondary Barrier - Any additional plastic barriers used to isolate and provide protection from debris during abatement work.

Breathing zone - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.

Bridging encapsulant - An encapsulant that forms a layer on the surface of the ACM.

Building/facility owner - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.

Bulk testing - The collection and analysis of suspect asbestos containing materials.

Certified Industrial Hygienist (CIH) - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.

Class I asbestos work - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).

Class II asbestos work - Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.

Clean room/Changing room - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.

Clearance sample - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's professional industrial hygiene consultant/Certified Industrial Hygienist (VPIH/CIH).

Closely resemble - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

Competent person - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.

Contractor's Professional Industrial Hygienist (CPIH/CIH) - The asbestos abatement contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of a PIH and may report to a certified industrial hygienist (CIH).

Count - Refers to the fiber count or the average number of fibers greater than five microns in length with a length-to-width (aspect) ratio of at least 3 to 1, per cubic centimeter of air.

Crawlspace – An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain asbestos materials and/or asbestos contaminated soil.

Decontamination area/unit - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

Demolition - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

Disposal bag - Typically 6-mil thick sift-proof, dustproof, leak-tight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.

Disturbance – Asbestos Operations and Maintenance Activities (OSHA Class III) that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or disposal bag, which shall not exceed 60 inches in length or width.

Drum - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.

Employee exposure - The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.

Encapsulant - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.

Encapsulation - Treating ACM with an encapsulant.

Enclosure - The construction of an air tight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.

Equipment room - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

Fiber - A particulate form of asbestos, 5 microns or longer, with a length to width (aspect) ratio of at least 3 to 1.

Fibers per cubic centimeter (f/cc) - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.

Filter - Media used in respirators, vacuums, or other machines to remove particulate from air.

Firestopping - Material used to close the open parts of a structure in order to prevent a fire from spreading.

Friable asbestos containing material - Any material containing more than one (1) percent asbestos as determined using the method specified in 40 CFR 763, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

Glovebag - Not more than a 60 x 60-inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.

High efficiency particulate air (HEPA) filter – An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

HEPA vacuum - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.

Homogeneous area - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.

HVAC - Heating, Ventilation and Air Conditioning

Industrial hygienist (IH) - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).

Industrial hygienist technician (IH Technician) - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned. Some states require that an industrial hygienist technician conducting asbestos abatement air sampling, clearance inspection and clearance air sampling be licensed as an asbestos project monitor.

Intact - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Lockdown - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.

National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA's rule to control emissions of asbestos to the environment (40 CFR part 61, Subpart M).

Negative initial exposure assessment - A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL or Excursion Limit (EL).

Negative pressure - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02-inch water column gauge inside the negative pressure enclosure.

Negative pressure respirator - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.

Non-friable ACM - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Organic vapor cartridge - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.

Outside air - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.

Owner/operator - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

Penetrating encapsulant - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.

Permissible exposure limit (PEL) - The level of exposure OSHA allows for as an eight (8) hour time-weighted average (TWA). For asbestos fibers, the eight (8) hour time-weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit (EL) is 1.0 fibers per cubic centimeter (1 f/cc).

Personal protective equipment (PPE) – equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, fall protection, and respirators.

Personal sampling/monitoring - Representative air samples obtained in the breathing zone for one or more workers within the regulated area using a filter cassette and a calibrated air sampling pump to determine asbestos exposure.

Pipe tunnel – An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, debris or asbestos-contaminated soil.

Polarized light microscopy (PLM) - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type of asbestos present in a bulk sample.

Polyethylene sheeting - Strong plastic barrier material 4 to 6-mils thick, semi-transparent, flame retardant per NFPA 241.

Positive/negative fit check - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator, respectively.

Presumed ACM (PACM) - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge, or should have known through the exercise of due diligence that other materials are ACM, they too must be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (k)(5).

Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH/CIH) or Contractor's PIH (CPIH/CIH).

Project designer - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Subpart E, Appendix C, Part I; (B)(5).

Assigned protection factor - A value assigned by OSHA/NIOSH to indicate the expected protection provided by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.

Qualitative fit test (QLFT) - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.

Quantitative fit test (QNFT) - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.

Regulated area - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become

crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.

Removal - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.

Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.

Repair - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.

Shower room - The portion of the PDF where personnel shower before leaving the regulated area.

Supplied air respirator (SAR) - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-2018.

Surfacing ACM - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, decorative, fireproofing and other purposes.

Surfactant - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.

Thermal system ACM - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.

Transmission electron microscopy (TEM) - A microscopy method that can identify and count asbestos fibers.

VA Professional Industrial Hygienist (VPIH/CIH) – The Department of Veterans Affairs Professional Industrial Hygienist must meet the qualifications of a PIH, and may report to a Certified Industrial Hygienist (CIH).

VA Representative - The VA official responsible for on-going project work.

VA Total – means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.

Visible emissions - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM/ACS or ACM waste material.

Waste/Equipment decontamination facility (W/EDF) – The area in which equipment is decontaminated before removal from the regulated area.

Waste generator - Any owner or operator whose act or process produces asbestos-containing waste material.

Waste shipment record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

Wet cleaning - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

C. Referenced Standards Organizations: See Section 01 42 19 REFERENCED STANDARDS.

1.5 APPLICABLE CODES AND REGULATIONS

A. General Applicability of Codes, Regulations, and Standards:

1. All work under this contract shall be done in strict accordance with all applicable Federal, State, and Local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.
2. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.
3. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system and/or the Contractor's on-site Field Office. These standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 may be made available electronically.

B. Asbestos Abatement Contractor Responsibility: The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE), respiratory protection, and respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Abatement Contractor will incur all costs of the CPIH/CIH, including all sampling/analytical costs to assure compliance with OSHA/EPA/State/Local requirements related to failure to comply with the regulations applicable to the work.

C. Federal Requirements:

1. Federal requirements which govern asbestos abatement include, but are not limited to, the following regulations:
   a. Occupational Safety and Health Administration **(OSHA)**

1)Title 29 CFR 1926.1101 - Construction Standard for Asbestos

2)Title 29 CFR 1926 Subpart E - Personal Protective Equipment and Life Saving Equipment

3)Title 29 CFR 1910.134 - Respiratory Protection

4)Title 29 CFR 1926 - Construction Industry Standards

5)Title 29 CFR 1926.33 - Access to Employee Exposure and Medical Records

6)Title 29 CFR 1926.59 same as 1910.1200 - Hazard Communication

7)Title 29 CFR 1926 Subpart C – General Safety and Health Provisions and Subpart D – Occupational Health and Environmental Controls

b. Environmental Protection Agency **(EPA)**:

1)40 CFR 61 Subpart M - National Emission Standard for Hazardous Air Pollutants - Asbestos.

2)40 CFR 763 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos Hazard Abatement Reauthorization Act (ASHARA)

c. Department of Transportation **(DOT)**

1)Title 49 CFR 171 - 180 – Transportation

D. State Requirements:

1. State requirements that apply to the asbestos abatement work, disposal, clearance, etc., include, but are not limited to, the following.
2. The Ohio Administrative Code (OAC) 3745-20 contains regulations for controlling asbestos emissions from demolition and renovation projects. Ohio's regulations are consistent with U.S. EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) regarding asbestos. The regulations require that contractors do several things, such as provide a notification, conduct thorough inspections to determine the presence of asbestos, follow specific work practices, and ensure proper disposal of asbestos-containing material.
3. The Ohio EPA asbestos program licenses and certifies companies and persons directly involved with the asbestos abatement industry. OAC 3745-22 contains regulations pertaining to contractors performing asbestos removal projects, project supervisors, project designers, workers removing asbestos, persons inspecting buildings for asbestos-containing materials and developing plans to manage asbestos found in a facility, persons conducting air sampling for asbestos and the companies that provide required asbestos training. The asbestos program ensures the safety and quality of asbestos services by requiring persons to take approved training that is specific to the asbestos related activities in which they will be involved and by inspecting/auditing the activities of the program participants.

E. Local Requirements:

1. If local requirements are more stringent than federal or state standards, the local standards are to be followed.

2. Montgomery County, Ohio Regulation 150.

F. Standards:
1. Standards which govern asbestos abatement activities include, but are not limited to, the following:
   a. American National Standards Institute (ANSI)/ASSP Z9.2-2018 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI/ASSE Z88.2-2015 - Practices for Respiratory Protection.
   b. Underwriters Laboratories (UL) 586-2009 - UL Standard for Safety of HEPA Filter Units, 9th Edition; ANSI Approval 2017-12-19.
2. Standards which govern encapsulation work include, but are not limited to the following:
   a. American Society for Testing and Materials International (ASTM)
3. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
   a. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
   b. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
   c. NFPA 101 - Life Safety Code

G. EPA Guidance Documents:
1. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference.
2. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024
3. Asbestos Waste Management Guidance EPA 530-SW-85-007
4. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001
5. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990

H. Notices:
1. State and Local agencies: Send written notification as required by State and Local regulations prior to beginning any work on ACM as follows:
   Submit prior abatement notification to the Ohio EPA at least 10-business days prior to start of work. Ohio EPA notifications can be completed online at www.ebiz.epa.ohio.gov.

2. Copies of notifications shall be submitted to the VA for the facility's records in the same time frame notification are given to EPA, State, and Local authorities.

I. Permits/Licenses: The contractor shall apply for and have all required permits and licenses to perform asbestos abatement work as required by Federal, State, and Local regulations.

J. Posting and Filing of Regulations: Maintain two (2) copies of applicable Federal, State, and Local regulations. Post one copy of each in the clean room at the regulated area where workers will have daily access to the regulations and keep another hard copy or electronic copy in the Contractor's office.

K. VA Responsibilities prior to commencement of work:

1. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment, and personal possessions to avoid unauthorized access into the regulated area. **Note: Notification of adjacent personnel is required by OSHA in 29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area**.
2. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized, calibration data and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

L. Emergency Action Plan and Arrangements:

1. An Emergency Action Plan shall be developed prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1926, Subpart C, Standard 1926.35 Employee Emergency Action Plans.
2. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
3. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.
4. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.
5. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
   a. For non-life-threatening situations - employees injured or otherwise incapacitated shall be decontaminated following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.

b. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, medical personnel shall remove them from the regulated area if back or neck injury is present, and secure proper medical treatment.

6. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
7. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.
8. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the standard operating procedures during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

M. Pre-Construction Meeting:

1. Prior to commencing the work, the Contractor shall meet with the VA Certified Industrial Hygienist (VPIH/CIH) to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:

a. Proof of Contractor licensing.
b. Proof the Competent Person(s) is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person(s) shall also be presented.
c. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
d. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.
e. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.1101 (m).
f. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.
g. A copy of the Contractor's Asbestos Hazard Abatement Plan. In these procedures, the following information must be detailed, specific for this project.
   1)Regulated area preparation procedures;
   2)Notification requirements procedure of Contractor as required in 29 CFR 1926.1101 (d) Multi-Employer Worksites;

3)Decontamination area set-up/layout and decontamination procedures for employees;

4)Abatement methods/procedures and equipment to be used;

5)Personal protective equipment to be used.

h. At this meeting the Contractor shall provide all submittals as required.

i. Procedures for handling, packaging and disposal of asbestos waste.

j. Emergency Action Plan and Contingency Plan Procedures.

1.6 PROJECT COORDINATION

A. The following are the minimum administrative and supervisory personnel necessary for coordination of the work.

1. Personnel:

a. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.

b. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; last four digits of social security number; qualifications; accreditation card with color picture, if required by state; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.

c. Minimum qualifications for Contractor and assigned personnel are:

1)The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of federal (and State or Local as applicable) EPA and OSHA asbestos regulations in the past three (3) years; has adequate liability/occurrence insurance for asbestos work as required by the state; is licensed in applicable state; has adequate and qualified personnel available to complete the work; has comprehensive standard operating procedures for asbestos work; has adequate materials, equipment and supplies to perform the work.

2)The Competent Person has three (3) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has

completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.

3)The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have three (3) years of monitoring experience and supervision of asbestos abatement projects; has participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.

4)The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the standard operating procedures of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; has certificate of training/current refresher and State accreditation/license.

d. All personnel shall be in compliance with OSHA construction safety training as applicable and submit certification.

1.7 RESPIRATORY PROTECTION

A. General - Respiratory Protection Program: The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.134. ANSI Standard Z88.2-2015 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c) - Respiratory Protection Program.

B. Respiratory Protection Program Coordinator: The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years of experience coordinating RPP of similar size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

C. Selection and Use of Respirators: The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit or in the onsite Contractor’s office, for reference by employees or authorized visitors.

D. Minimum Respiratory Protection: Shall be a ½-mask negative pressure air purifying respirator equipped with P100 filters, provided personal air samples in the workplace remain at or below 0.1

f/cc, determined as an 8-hour TWA. Full face powered air purifying respirator equipped with P100 filters shall be required until Contractor demonstrates that personal air samples are at or below 0.1 f/cc, determined as an 8-hour TWA. A higher level of respiratory protection shall be required, if fiber levels exceed 1 f/cc as an 8-hour TWA, inside the regulated work area. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h) and 29 CFR 1910.134 (d)(3)(i)(A) Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

E. Medical Written Opinion: No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination, they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

F. Respirator Fit Test: All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Quantitative fit tests shall be done for PAPRs which have been put into a motor/blower failure mode.

G. Respirator Fit Check: The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from entering the regulated area until resolution of the problem.

H. Maintenance and Care of Respirators: The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) Maintenance and Care of Respirators.

I. Supplied Air Systems: If a supplied air system is used, the system shall meet all requirements of 29 CFR 1910.134 and the ANSI/Compressed Gas Association (CGA) Commodity Specification for Air current requirements for Type 1 - Grade D breathing air. Low pressure systems are not allowed to be used on asbestos abatement projects. Supplied Air respirator use shall be in accordance with EPA/NIOSH publication EPA-560-OPTS-86-001 "A Guide to Respiratory Protection for the Asbestos Abatement Industry". The competent person on site will be responsible for the supplied air system to ensure the safety of the worker.

1.8 WORKER PROTECTION

A. Training of Abatement Personnel: Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Initial training

certificates and current refresher and accreditation proof must be submitted for each person working at the site.

B. Medical Examinations: Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion that the person has been evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

C. Regulated Area Entry Procedure: The Competent Person shall ensure that each time workers enter the regulated area; they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

D. Decontamination Procedure: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.

1. When exiting the regulated area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.
2. Still wearing the respirator and completely naked, proceed to the shower. Showering is MANDATORY. Care must be taken to follow reasonable procedures in removing the respirator to avoid inhaling asbestos fibers while showering. The following procedure is required as a minimum:
   a. Thoroughly wet body including hair and face. If using a PAPR hold blower above head to keep filters dry.
   b. With respirator still in place, thoroughly decontaminate body, hair, respirator face piece, and all other parts of the respirator except the blower and battery pack on a PAPR. Pay particular attention to cleaning the seal between the face and respirator facepiece and under the respirator straps.
   c. Take a deep breath, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.
3. Carefully decontaminate the facepiece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) carefully decontaminate battery pack with a wet rag being cautious of getting water in the battery pack thus preventing destruction. **(THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!)**
4. Shower and wash body completely with soap and water. Rinse thoroughly.

5. Rinse shower room walls and floor to drain prior to exiting.
6. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

E. Regulated Area Requirements: The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for regulated areas at 29 CFR 1926.1101 (e) are met. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

A. Description: Provide each regulated area with separate personnel decontamination facilities (PDF) and waste/equipment decontamination facilities (W/EDF). Ensure that the PDF are the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the W/EDF.

B. General Requirements: All personnel entering or exiting a regulated area must go through the PDF and shall follow the requirements at 29 CFR 1926.1101 (j)(1) and these specifications. All waste, equipment and contaminated materials must exit the regulated area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF must be constructed of a minimum of 3 layers of 6-mil opaque fire-retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 3 layers of 6-mil poly shall also be used to cover the floor under the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape or approved equivalent so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

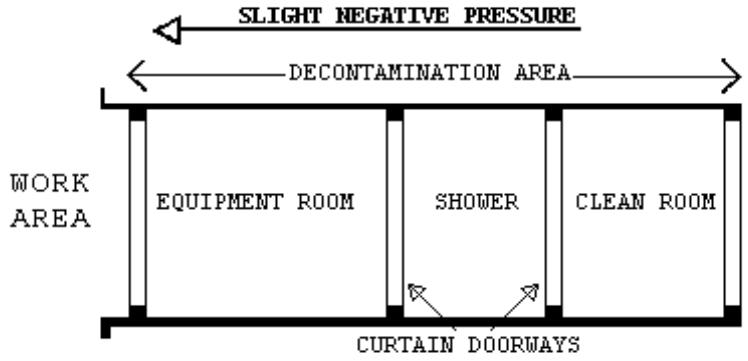
C. Temporary Facilities to the PDF and W/EDF: The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention must be provided at the point of connection to the VA system. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141(d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel equipped with GFCI protection for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50-foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70 degrees F throughout the PDF and W/EDF.

D. Personnel Decontamination Facility (PDF): The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room which is connected to the regulated area. The PDF must be sized to accommodate the number of personnel scheduled for the project. The shower room, located in the center of the PDF, shall be

fitted with as many portable showers as necessary to insure all employees can complete the entire decontamination procedure within 15 minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.

1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3 layers of 6-mil opaque fire-retardant poly to provide an airtight room. Provide a minimum of 2 - 900 mm (3 foot) wide 6-mil poly opaque fire-retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry and sanitary condition. Shower overflow shall not be allowed into the clean room. Provide one (1) storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Male/Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male/female can enter or exit the PDF during his/her stay in the PDF.
2. Shower Room: The Competent Person shall assure that the shower room is a completely watertight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using airtight walls made from at least 3 layers of 6-mil opaque fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Wastewater will be pumped to a drain after being filtered through a minimum of a 100-micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters will be changed a minimum of daily or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste.

3. Equipment Room: The Competent Person shall provide an equipment room which shall be an airtight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The Competent Person shall ensure that most gross contamination is removed from the outside of PPE, suits and respirators in the regulated work area, prior to entering the Equipment Room. The equipment room shall be separated from the regulated area by a minimum 3-foot-wide door made with 2 layers of 6-mil opaque fire retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by airtight walls and ceiling constructed of a minimum of three (3) layers of 6-mil opaque fire retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6-mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area.
4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of two (2) layers of 6-mil opaque fire-retardant poly.



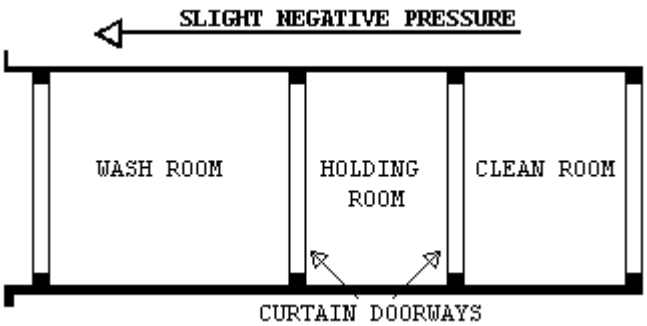
E. Waste/Equipment Decontamination Facility (W/EDF):
1. The Competent Person shall provide a W/EDF consisting of a washroom, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:
   a. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Washroom as an equipment bag and container cleaning station.

b. Washroom: Provide a washroom for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the washroom using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and three (3) layers of 6-mil fire retardant poly. Locate the washroom so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the washroom shall be constructed of two (2) layers of 6-mil fire retardant poly.

c. Holding Room: Provide a holding room as a drop location for bagged materials passed from the washroom. Construct the holding room using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and three (3) layers of 6-mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the washroom to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of two (2) layers of 6-mil fire retardant poly.

d. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 inches x 4 inches wood framing or approved equivalent and two (2) layers of 6-mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of two (2) layers of 6-mil fire retardant poly. When a negative pressure differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.

e. The W/EDF shall be as follows: Washroom leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



F. Waste/Equipment Decontamination Procedures: At the washdown station in the regulated area, thoroughly wet clean contaminated equipment and/or sealed polyethylene bags and pass into Washroom after visual inspection. When passing anything into the Washroom, close all doorways of the W/EDF, other than the doorway between the washdown station and the Washroom. Keep all outside personnel clear of the W/EDF. Once inside the Washroom, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean

Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. At no time shall personnel from the clean side be allowed to enter the Washroom.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. General Requirements: Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's representative.

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mils. For floors and all other uses, sheeting of at least 6-mil shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
6. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape, poly tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or approved equivalent procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
7. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6-mil fire retardant poly.
8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and wastewater filtration system shall be provided by the Contractor.
9. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose

to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.

10. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
11. Disposal bags – two (2) layers of 6-mil poly for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
12. The VA shall be provided an advance copy of the Safety Data Sheets (SDS) as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-start meeting submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
13. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.
14. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

2.2 MONITORING, INSPECTION AND TESTING

A. General:

1. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the employee exposure to asbestos must not exceed 0.1 fiber per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples inside the building, but outside the regulated area. Inside the building, but outside the regulated area air samples shall be collected in the Clean Room of the PDF, at the approximate location of HEPA exhaust discharge, and at a minimum of three (3) locations in areas immediately outside the regulated work area to satisfy this specification. Additional inspection and testing requirements are also indicated in other parts of this specification.
2. The General Contractor will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by

the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the General Contractor including any repeat of final inspection and testing that may be required due to unsatisfactory initial results.

3. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH/CIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's representative.

B. Scope of Services of the VPIH/CIH Consultant:

1. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the regulated area; and assure clearance at the end of the project. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:
   a. Task 1: May establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
   b. Task 2: Perform representative air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
   c. Task 3: Perform unannounced visits inside the regulated work area to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.

d. Task 4: Provide support to the VA representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.
e. Task 5: Perform final inspection and testing of a decontaminated regulated area at the conclusion of the abatement to certify compliance with all regulations and VA requirements/specifications.
f. Task 6: Issue a final abatement project monitoring report.

2. All documentation, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.
3. The monitoring and inspection results of the VPIH/CIH may be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

C. Monitoring, Inspection and Testing by Contractor CPIH/CIH: The Contractor's CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor's personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH Technician shall have successfully completed a NIOSH 582 Course or equivalent and provide documentation. The IH Technician shall participate in the AIHA Asbestos Analysis Registry or participate in the Proficiency Analytical Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and area samples and have experience in substantially similar projects in size and scope. The analytical laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT and approved by the VA prior to start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for personal and area air monitoring for asbestos in 29 CFR 1926.1101(f), (g) and Appendix A. This log shall be made available to the VA representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. No fewer than two (2) personal air samples or 25 percent of

representative workforce per shift shall be collected, whichever is greater, in the regulated area; a minimum of three (3) area air samples at locations inside the building but immediately outside the regulated work area; one (1) area air sample shall be collected daily in the Clean Room of the PDF; and one (1) area air sample shall be collected daily at the approximate location of HEPA exhaust discharge. In addition to the continuous monitoring required, the CPIH/CIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities. Additionally, the CPIH/CIH will monitor and record pressure readings within the containment daily with a minimum of two readings at the beginning and at the end of a shift, and submit the data in the daily report.

2.3 ASBESTOS HAZARD ABATEMENT PLAN

A. The Contractor shall have an established an Asbestos Hazard Abatement Plan (AHAP) in printed form and loose-leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the procedures to be followed during all phases of the work by the Contractor's personnel. The AHAP must be modified as needed to address specific requirements of this project and the specifications. The AHAP shall be submitted for review and approval to the VA prior to the start of any abatement work. The minimum topics and areas to be covered by the AHAPs are:

1. Minimum Personnel Qualifications
2. Emergency Action Plan/Contingency Plans and Arrangements
3. Security and Safety Procedures
4. Respiratory Protection/Personal Protective Equipment Program and Training
5. Medical Surveillance Program and Recordkeeping
6. Regulated Area Requirements - Containment Barriers/Isolation of Regulated Area
7. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF)
8. Negative Pressure Systems Requirements
9. Monitoring, Inspections, and Testing
10. Removal Procedures for ACM
11. Removal of Contaminated Soil (if applicable)
12. Encapsulation Procedures for ACM
13. Disposal of ACM waste/equipment
14. Regulated Area Decontamination/Clean-up
15. Regulated Area Visual and Air Clearance
16. Project Completion/Closeout

2.4 SUBMITTALS

A. Pre-Start Meeting Submittals:

1. Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:
   a. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
   b. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
   c. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.
   d. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
      1)Supplied air system, negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
      2)Wastewater filtration system, shower system, containment barriers.
      3)Encapsulants, surfactants, handheld sprayers, airless sprayers, glovebags, and fire extinguishers.
      4)Respirators, protective clothing, fall protection and other required personal protective equipment.
      5)Fire safety equipment to be used in the regulated area.
   e. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
   f. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.
   g. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. Area or clearance air monitoring shall be conducted in accordance with EPA AHERA protocols.

h. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.

1)Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; Completion Date

2)List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution

3)List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal and state EPA), penalties, and legal actions taken against the company including the company's officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.

i. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulation. Submit the phone number and doctor/clinic/hospital used for medical evaluations.

1)CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; medical opinion; and current respirator fit test.

2)Competent Person(s)/Supervisor(s): Number; names; last four digits of social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

3)Workers: Numbers; names; last four digits of social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

j. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy

of AHAPs incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and standard operating procedures; and copies of monitoring results of the five referenced projects listed and analytical methods used.

k. Rented equipment must be decontaminated prior to returning to the rental agency.

l. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all SDS and application instructions.

B. Submittals During Abatement:

1. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; and representative air monitoring and results/TWA's/EL's. Submit this information daily to the VA's representative.

2. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.

a. Removal of any poly barriers.

b. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant.

c. Packaging and removal of ACM waste from regulated area.

d. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's representative on a weekly basis.

C. Submittals at Completion of Abatement: The CPIH/CIH shall submit a project report consisting of the daily logbook requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area samples must be submitted. The VA representative will retain the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

2.5 ENCAPSULANTS

A. Types of Encapsulants:

1. The following four types of encapsulants, if used, must comply with performance requirements as stated in paragraph 2.5.2:

a. Removal encapsulant - used as a wetting agent to remove ACM.

b. Bridging encapsulant - provides a tough, durable coating on ACM.

c. Penetrating encapsulant - penetrates/encapsulates ACM at least 13 mm (1/2 inches).

d. Lockdown encapsulant - seals microscopic fibers on surfaces after ACM removal.

B. Performance Requirements:

1. Encapsulants shall meet the latest requirements of EPA; shall not contain toxic or hazardous substances; or solvents; and shall comply with the following performance requirements:

a. General Requirements for all Encapsulants:

1)ASTM E84: Flame spread of 25; smoke emission of 50.

2)University of Pittsburgh Protocol: Combustion Toxicity; zero mortality.

3)ASTM C732: Accelerated Aging Test; Life Expectancy - 20 years.

4)ASTM E96: Permeability - minimum of 0.4 perms.

b. Bridging/Penetrating Encapsulants:

1)ASTM E736: Cohesion/Adhesion Test - 24 kPa (50 pounds/square foot).

2)ASTM E119: Fire Resistance - 3 hours (Classified by UL for use on fibrous/cementitious fireproofing).

3)ASTM D2794: Gardner Impact Test; Impact Resistance - minimum 11.5 kg-mm (43 in/lb).

4)ASTM D522: Mandrel Bend Test; Flexibility - no rupture or cracking.

c. Lockdown Encapsulants:

1)ASTM E119: Fire resistance - 3 hours (tested with fireproofing over encapsulant applied directly to steel member).

2)ASTM E736: Bond Strength - 48 kPa (100 pounds/square foot) (test compatibility with cementitious and fibrous fireproofing).

3)In certain situations, encapsulants may have to be applied to hot pipes/equipment. The encapsulant must be able to withstand high temperatures without cracking or creating any noxious gaseous or vapors during or after application.

C. Certificates of Compliance: The Contractor shall submit to the VA representative certification from the manufacturer indicating compliance with performance requirements for encapsulants when applied according to manufacturer recommendations.

PART 3 - EXECUTION

3.1 REGULATED AREA PREPARATIONS

A. Site Security:

1. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and representatives, State and Local inspectors, and any other designated

individuals. A list of authorized personnel shall be established prior to commencing the project and be posted in the clean room of the decontamination unit.

2. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent Person shall immediately require any unauthorized person to leave the regulated area and then notify the VA Contracting Officer or VA Representative using the most expeditious means.
3. A logbook shall be maintained in the clean room of the decontamination unit. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.
4. Access to the regulated area shall be through a single decontamination unit. All other access (doors, windows, hallways, etc.) shall be sealed and demarcated as an asbestos regulated work area to prevent entry to or exit from the regulated area unless in the event of an emergency. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall not be locked from the inside; however, they shall be sealed with poly sheeting and taped until needed. In any situation where exposure to high temperatures which may result in a flame hazard, fire retardant poly sheeting must be used.
5. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24-hour security system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.
6. The Contractor will have the VA's assistance in notifying adjacent personnel of the presence, location and quantity of ACM in the regulated area and enforcement of restricted access by the VA's employees.
7. The regulated area shall be locked during non-working hours and secured by VA Representative or Competent Person. The VA Police shall be informed of asbestos abatement regulated areas to provide security checks during facility rounds and emergency response.

B. Signage and Power Management:

1. Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.
2. Shut down and lock out/tag out electric power to the regulated area. Provide temporary power and lighting. Ensure safe installation including GFCI of temporary power sources and

equipment by compliance with all applicable electrical code and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.

3. Shut down and lock out/tag out heating, cooling, and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Investigate the regulated area and agree on pre-abatement condition with the VA's representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2 layers of independently installed 6-mil poly. Also, seal any seams in system components that pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil polyethylene disposal bags for staging and eventual disposal as asbestos waste.

C. Negative Pressure Filtration System:

1. The Contractor shall provide enough HEPA negative air machines to effect ≥ - 0.02 inch WCG pressure differential inside the regulated work area. The Competent Person shall determine the number of units needed for the regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to effect ≥ - 0.02 inch WCG pressure inside the regulated work area. Provide standby units in the event of machine failure and/or emergency in an adjacent area. HEPA equipped negative air machines shall be discharged outside of the building a minimum of 30 feet from building make-up air, doors, open windows, patients, visitors and staff.
2. NIOSH has done extensive studies and has determined that negative air machines typically operate at ~50 percent efficiency. The contractor shall consider this in their determination of number of units needed to provide ≥ - 0.02 inch WCG pressure differential inside the regulated work area. The contractor shall use double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2 inches pressure drop across the filters.
3. Design and Layout:
   a. Before start of work submit the design and layout of the regulated area and the negative air machines. The submittal shall indicate the number of, location of and size of negative air machines. The point(s) of exhaust, air flow within the regulated area, anticipated negative pressure differential, and supporting calculations for sizing shall be provided. In addition, submit the following:
      1)Method of supplying power to the units and designation/location of the panels.
      2)Description of testing method(s) for correct air volume and pressure differential.
      3)If auxiliary power supply is to be provided for the negative air machines, provide a schematic diagram of the power supply and manufacturer's data on the generator and switch.
4. Negative Air Machines (HEPA Units):

a. Negative Air Machine Cabinet: The cabinet shall be constructed of steel or other durable material capable of withstanding potential damage from rough handling and transportation. The width of the cabinet shall be less than 30 inches in order to fit in standard doorways. The cabinet must be factory sealed to prevent asbestos fibers from being released during use, transport, or maintenance. Any access to and replacement of filters shall be from the inlet end. The unit must be on casters or wheels.

b. Negative Air Machine Fan: The rating capacity of the fan must indicate the CFM under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan must be a centrifugal type fan.

c. Negative Air Machine Final Filter: The final filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an airtight seal. Each HEPA filter shall be certified by the manufacturer to have an efficiency of not less than 99.97 percent. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter must bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.

d. Negative Air Machine Pre-filters: The pre-filters, which protect the final HEPA filter by removing larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. A first stage pre-filter shall be a low efficiency type for particles 10 µm or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5 µm or larger. Pre-filters shall be installed either on or in the intake opening of the NAM and the second stage filter must be held in place with a special housing or clamps.

e. Negative Air Machine Instrumentation: Each unit must be equipped with a gauge to measure the pressure drop across the filters and to indicate when filters have become loaded and need to be changed. A table indicating the cfm for various pressure readings on the gauge shall be affixed near the gauge for reference or the reading shall indicate at what point the filters shall be changed, noting cfm delivery. The unit must have an elapsed time meter to show total hours of operation.

f. Negative Air Machine Safety and Warning Devices: An electrical/ mechanical lockout must be provided to prevent the fan from being operated without a HEPA filter. Units must be equipped with an automatic shutdown device to stop the fan in the event of a rupture in the HEPA filter or blockage in the discharge of the fan. Warning lights are required to indicate normal operation; too high a pressure drop across filters; or too low of a pressure drop across filters.

g. Negative Air Machine Electrical: All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriters Laboratories (UL). Each unit must be provided with overload protection and the motor, fan, fan housing, and cabinet must be grounded.

h. It is essential that replacement HEPA filters be tested using an “in-line” testing method, to ensure the seal around the periphery was not damaged during replacement. Damage to the outer HEPA filter seal could allow contaminated air to bypass the HEPA filter and be discharged to an inappropriate location. Contractor will provide written documentation of test results for negative air machine units with HEPA filters.

5. Pressure Differential: The fully operational negative air system within the regulated area shall continuously maintain a pressure differential ≥ - 0.02 inch WCG inside the regulated work area. Before any disturbance of any asbestos material, this shall be demonstrated to the VA by use of a pressure differential meter/manometer as required by OSHA 29 CFR 1926.1101(g)(5)(i). The Competent Person shall be responsible for providing, maintaining, and documenting the negative pressure and air changes as required by OSHA and this specification.

6. Monitoring: The pressure differential shall be continuously monitored and recorded between the regulated area and the area outside the regulated area with a monitoring device that incorporates a strip chart recorder. The strip chart recorder shall become part of the project log and shall indicate at least ≥ - 0.02 inch WCG pressure differential inside the regulated work area for the duration of the project.

7. Auxiliary Generator: If the building is occupied during abatement, provide an auxiliary gasoline/diesel generator located outside the building in an area protected from the weather. In the event of a power failure of the general power grid and the VAMC emergency power grid, the generator must automatically start and supply power to a minimum of 50 percent of the negative air machines in operation.

8. Supplemental Make-Up Air Inlets: Provide, as needed for proper air flow in the regulated area, in a location approved by the VA, openings in the plastic sheeting to allow outside air to flow into the regulated area. Auxiliary makeup air inlets must be located as far from the negative air machines as possible, off the floor near the ceiling, and away from the barriers that separate the regulated area from the occupied clean areas. Cover the inlets with weighted flaps which will seal in the event of failure of the negative pressure system.

9. Testing The System: The negative pressure system must be tested before any ACM is disturbed in any way. After the regulated area has been completely prepared, the decontamination units set up, and the negative air machines installed, start the units up one at a time. Demonstrate and document the operation and testing of the negative pressure system to the VA using smoke tubes and a negative pressure gauge. Verification and

documentation of adequate negative pressure differential across each barrier must be done at the start of each work shift.

10. Demonstration of the Negative Pressure Filtration System:
    a. The demonstration of the operation of the negative pressure system to the VA shall include, but not be limited to, the following:
        1)Plastic barriers and sheeting move lightly in toward the regulated area.
        2)Curtains of the decontamination units move in toward regulated area.
        3)There is a noticeable movement of air through the decontamination units. Use the smoke tube to demonstrate air movement from the clean room to the shower room to the equipment room to the regulated area.
        4)Use smoke tubes to demonstrate air is moving across all areas in which work is to be done. Use a differential pressure gauge to indicate a negative pressure of at > - 0.02 inch across every barrier separating the regulated area from the rest of the building. Modify the system as necessary to meet the above requirements.
11. Use of the Negative Pressure Filtration System During Abatement Operations:
    a. Start units before beginning any disturbance of ACM occurs. After work begins, the units shall run continuously, maintaining 4 actual air changes per hour at a negative pressure differential of > - 0.02 inch water column gauge, for the duration of the work until a final visual clearance and final air clearance has been successfully completed.
    b. No negative air units shall be shut down at any time unless authorized by the VA Contracting Officer, verbally and in writing.
    c. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.
    d. Abatement work shall begin at a location farthest from the units and proceed towards them. If an electric failure occurs, the Competent Person shall stop all abatement work and immediately begin wetting all exposed asbestos materials for the duration of the power outage. Abatement work shall not resume until power is restored and all units are operating properly again.
    e. The negative air machines shall continue to run after all work is completed and until a final visual clearance and a final air clearance has been successfully completed for that regulated area.
12. Dismantling The System: After completion of the final visual and final air clearance has been obtained by the VPIH/CIH, the units may be shut down. The unit exterior surfaces shall have been completely decontaminated; pre-filters are not to be removed and the units inlet/outlet sealed with 2 layers of 6-mil poly immediately after shut down. No filter removal shall occur at

the VA site following successful completion of site clearance. OSHA/EPA/DOT asbestos labels shall be attached to the units.

D. Containment Barriers and Coverings in the Regulated Area:

1. General: Seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area must be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated as a result of the work, Contractor shall immediately stop work and clean up the contamination at no additional cost to the VA. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 3.1.4.8; FIRESTOPPING.
2. Preparation Prior To Sealing: The Regulated Area: Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects not scheduled for removal remaining in the regulated area shall be completely covered with 2 layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area.
3. Controlling Access to The Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF). All other means of access shall be eliminated, and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to, or within view of an occupied area, provide a visual barrier of 6-mil opaque fire retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.
4. Critical Barriers: Completely separate any operations in the regulated area from adjacent areas using 2 layers of 6-mil fire retardant poly and duct tape. Individually seal with 2 layers of 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.
5. Primary Barriers:
   a. Cover the regulated area with two layers of 6-mil fire retardant poly on the floors and two layers of 4 mil, fire retardant poly on the walls, unless otherwise directed in writing by the VA representative. Floor layers must form a right angle with the wall and turn up the wall at least 300 mm (12 inches). Seams must overlap at least 1800 mm (6 feet) and must be spray glued and taped. Install sheeting so that layers can be removed independently from each other. Carpeting shall be covered with three layers of 6-mil poly. Corrugated cardboard sheets must be placed between the bottom and middle layers of poly. Mechanically support and seal with duct tape and glue all wall layers.

b. If stairs and ramps are covered with 6-mil plastic, two layers must be used. Provide 19 mm (3/4 inch) exterior grade plywood treads held in place with duct tape/glue on the plastic. Do not cover rungs or rails with any isolation materials.

6. Secondary Barriers: A loose layer of 6-mil shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced as needed during the work.
7. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. Decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.
8. Firestopping:
   a. Through penetrations caused by cables, cable trays, pipes, sleeves, conduits, etc. must be fire stopped with a fire-rated firestop system providing an air tight seal.
   b. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.
   c. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed.

E. Sanitary Facilities: The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.

F. Personal Protective Equipment: Provide whole body clothing, head coverings, gloves and foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

G. Pre-Cleaning:
   1. The VA will provide water for abatement purposes. The Contractor shall connect to the existing VA system. The service to the shower(s) shall be supplied with backflow prevention.
   2. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. All workers performing pre-cleaning activities must don appropriate personal protective equipment (PPE), as specified throughout this document and as approved in the Contractor’s work plan. After

items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.

3. Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location. Drapes, clothing, upholstered furniture and other fabric items shall be disposed of as asbestos contaminated waste. Cleaning these asbestos contaminated items utilizing HEPA vacuum techniques and off-premises steam cleaning is very difficult and cannot guarantee decontamination. Carpeting will be disposed of prior to abatement if in the regulated area. If ACM floor tile is attached to the carpet while the Contractor is removing the carpet that section of the carpet will be disposed of as asbestos waste.

4. Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums and/or wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult, but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with 2 layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must remain in the regulated area and that require special ventilation or enclosure requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.

5. Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos-containing materials during this pre-cleaning phase.

H. Pre-Abatement Activities:

1. Pre-Abatement Meeting: The VA representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH/CIH that all materials and equipment required for the project are on the site, will arrange for a pre-abatement meeting between the Contractor, the CPIH/CIH, Competent Person(s), the VA representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/documentation to the VA's representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any

outstanding issues, the VA's representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.

2. Pre-Abatement Construction and Operations:
   a. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
   b. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's representative when the work is completed in accordance with this specification. The VA's representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP(s), especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for respiratory protection and the negative pressure system shall be demonstrated for proper performance.
   c. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's representative.
   d. Upon satisfactory inspection of the installation of and operation of systems, the VA's representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification and all applicable regulations.
3. Pre-Abatement Inspections and Preparations:
   a. Before any work begins on the construction of the regulated area, the Contractor will:
      1)Conduct a space-by-space inspection with an authorized VA representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.
      2)A NESHAP (destructive) ACM inspection shall be conducted on all building structures that will be demolished. Ensure the following areas are inspected on the project: lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside utility chases/walls; cementitious (transite™) piping/ductwork/sheets; behind radiators; lab fume hoods; cementitious (transite™) lab countertops; roofing materials; below window sills; water/sewer lines; electrical conduit coverings; crawlspaces (previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; and steam line trench coverings. Verify during NESHAP survey that no other suspect ACM is present.

3)Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination.

4)If present and required, remove and dispose of carpeting from floors in the regulated area.

5)Inspect existing firestopping in the regulated area. Correct as needed.

3.2 REMOVAL OF ACM

A. Wetting ACM:

1. Use amended water for the wetting of ACM prior to removal. The Competent Person shall assure the wetting of ACM meets the definition of "adequately wet" in the EPA NESHAP regulation and OSHA's "wet methods" for the duration of the project. A removal encapsulant may be used instead of amended water with written approval of the VA's representative.
2. Amended Water: Provide water to which a surfactant has been added to wet the ACM and reduce the potential for fiber release during disturbance of ACM. The mixture must be equal to or greater than the wetting provided by water amended by a surfactant consisting of one ounce of 50 percent polyoxyethylene ester and 50 percent polyoxyethylene ether mixed with 5 gallons (19L) of water.
3. Removal Encapsulant: When authorized by VA, provide a removal encapsulant designed specifically for the removal of ACM. The material must, when used, result in adequate wetting of the ACM and retard fiber release during removal.

B. Secondary Barrier and Walkways:

1. Install as a drop cloth a 6-mil poly sheet at the beginning of each work shift where removal is to be done during that shift. Completely cover floors and any walls within 10 feet (3 meters) of the area where work is to be done. Secure the secondary barrier with duct tape to prevent it from moving or debris from getting behind it. Remove the secondary barrier at the end of the shift or as work in the area is completed. Keep residue on the secondary barrier wetted. When removing, fold inward to prevent spillage and place in a disposal bag.
2. Install walkways using 6-mil black poly between the regulated area and the decontamination facilities (PDF and W/EDF) to protect the primary layers from contamination and damage. Install the walkways at the beginning of each shift and remove at the end of each shift.

C. Wet Removal of ACM:

1. Adequately and thoroughly wet the ACM to be removed prior to removal with amended water or when authorized by VA, removal encapsulant to reduce/prevent fiber release to the air. Adequate time must be allowed for the amended water or removal encapsulant to saturate the ACM. Abatement personnel must not disturb dry ACM. Use a fine spray of amended water or removal encapsulant. Saturate the material sufficiently to wet to the substrate without causing excessive dripping. The material must be sprayed repeatedly/continuously

during the removal process in order to maintain adequately wet conditions. Removal encapsulants must be applied in accordance with the manufacturer's written instructions. Perforate or carefully separate, using wet methods, an outer covering that is painted or jacketed in order to allow penetration and wetting of the material. Where necessary, carefully remove covering while wetting to minimize fiber release. **In no event shall dry removal occur except when authorized in writing by the VPIH/CIH and VA when a greater safety hazard (e.g., electricity) is present**.

2. If ACM does not wet well with amended water due to composition, coating or jacketing, remove as follows:
   a. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.
   b. Remove saturated ACM in small sections. Do not allow material to dry out. As material is removed, bag material, while still wet into disposal bags. Twist the bag neck tightly, bend over (gooseneck) and seal with a minimum of three tight wraps of duct tape. Clean /decontaminate the outside of the bag of any residue and move to washdown station adjacent to W/EDF.
   c. Fireproofing or Architectural Finish on Scratch Coat: Spray with a fine mist of amended water or removal encapsulant. Allow time for saturation to the substrate. Do not over saturate causing excess dripping. Scrape material from substrate. Remove material in manageable quantities and control falling to staging or floor. If the falling distance is over 20 feet (6 meters), use a drop chute to contain material through descent. Remove residue remaining on the scratch coat after scraping is done using a stiff bristle hand brush. If a removal encapsulant is used, remove residue completely before the encapsulant dries. Periodically re-wet the substrate with amended water as needed to prevent drying of the material before the residue is removed from the substrate.
   d. Fireproofing or Architectural Finish on Wire Lath: Spray with a fine mist of amended water or removal encapsulant. Allow time to completely saturate the material. Do not over saturate causing excess dripping. If the surface has been painted or otherwise coated, cut small holes as needed and apply amended water or removal encapsulant from above. Cut saturated wire lath into 2 feet x 6 feet (50mm x 150mm) sections and cut hanger wires. Roll up complete with ACM, cover in burlap and hand place in disposal bag. Do not drop to floor. After removal of lath/ACM, remove any overspray on decking and structure using stiff bristle nylon brushes. Depending on hardness of overspray, scrapers may be needed for removal.
   e. Pipe/Tank/Vessel/Boiler Insulation: Remove the outer layer of wrap while spraying with amended water in order to saturate the ACM. Spray ACM with a fine mist of amended

water or removal encapsulant. Allow time to saturate the material to the substrate. Cut bands holding pre-formed pipe insulation sections. Slit jacketing at the seams, remove and hand place in a disposal bag. Do not allow dropping to the floor. Remove molded fitting insulation/mud in large pieces and hand place in a disposal bag. Remove any residue on pipe or fitting with a stiff bristle nylon brush. In locations where pipe fitting insulation is removed from fibrous glass or other non-asbestos insulated straight runs of pipe, remove fibrous material at least 6 inches from the point it contacts the ACM.

D. Wet Removal of Amosite:

1. The following areas shown on drawings indicate locations of amosite ACM which will require local exhaust ventilation and collection as described below, in addition to wet removal. Provide specific description /locations/ drawings.
2. Provide local exhaust ventilation and collection systems to assure collection of amosite fibers at the point of generation. A 300 mm (12") flexible rigid non-collapsing duct shall be shall be located no more than 600 mm (2 feet) from any scraping/brushing activity. Primary filters must be replaced every 30 minutes on the negative air machines. Each scraping/brushing activity must have a negative air machine devoted to it. For pre-molded pipe insulation or cutting wire lathe attach a 1200 mm (4 feet) square flared end piece on the intake of the duct. Support the duct horizontally at a point 600 mm (2 feet) below the work to effect capture. One person in the crew shall be assigned to operate the duct collection system on a continual basis.
3. Amosite does not wet well with amended water. Submit full information/documentation on the wetting agent proposed prior to start for review and approval by the VPIH/CIH and VA Contracting Officer. Ensure that the material is worked on in small sections and is thoroughly and continuously wetted. Package as soon as possible while wet. Remove as required.

E. Removal of ACM/Dirt Floors and Other Special Procedures:

1. Major Abatement on Dirt Floors: When working on dirt floors, remove all visible asbestos debris using wet methods after set-up of PDF, W/EDF, negative air systems as required. Perform work and decontaminate/clean-up; perform lockdown as needed and complete work as required in these specifications. The asbestos contaminated soil (ACS) shall be removed and/or enclosed.

2. Options for abatement of asbestos contaminated soil include: Removal of top 6 inches of soil; encapsulate the soil using shotcrete or other spray applied concrete materials. Considerations for which option to be used will be made by the VA representative. Factors which may affect which option to be used may include: access to the work area; height of the area (such as is there sufficient height to use concrete materials in the area, etc.). Soils

covered with permanent barriers **MUST HAVE PERMANENT SIGNAGE INSTALLED TO WARN AGAINST PENETRATION ASSOCIATED WITH POTENTIAL DISTURBANCE OF ASBESTOS.**

a. Remove ACS as shown on drawings to a minimum depth of 6 using wet methods. After wetting with amended water to minimize dust, shovel dirt into disposal bags. The CPIH/CIH shall closely monitor work conditions and take appropriate action to protect workers from over exposure to asbestos and heat stress. The minimum number of air changes per hour shall be six using negative air machines. Use of special vacuum truck equipped with HEPA filtration to remove soil is an acceptable option.

b. Enclosure of ACS using a concrete layer of 4 inches over the entire surface may also be done. Thoroughly dampen soil first with amended water before pouring concrete. Personnel shall be proficient in concrete finishing as well as asbestos trained.

3. Crawlspaces/Pipe Tunnels: When working in crawlspaces or pipe tunnels, remove all visible asbestos debris using wet methods (if possible) after set-up of PDF, W/EDF, and after establishing negative air systems as required. Perform work and decontaminate/clean-up; perform lockdown as needed and complete work as required in these specifications. The asbestos contaminated soil (ACS) shall be removed and/or enclosed. Clearance requirements include confirmation sampling of affected soil by Polarized Light Microscopy (PLM). Clearance sampling requirements are specified in Sections 3.6.4 3.6.5 and 3.6.6.

4. Options for abatement of asbestos contaminated soil include: Removal of top 6 inches of soil; encapsulate the soil using shotcrete or other spray applied concrete materials. Considerations for which option to be used will be made by the VA representative. Factors which may affect which option to be used may include: access to the work area; height of the area (such as is there sufficient height to use concrete materials in the area, etc.).

3.3 LOCKDOWN ENCAPSULATION

A. General: Lockdown encapsulation is an integral part of the ACM removal. At the conclusion of ACM removal and before removal of the primary barriers, the contractor shall encapsulate all surfaces with a bridging encapsulant.

B. Delivery and Storage: Deliver materials to the job site in original, new and unopened containers bearing the manufacturer's name and label as well as the following information: name of material, manufacturer's stock number, date of manufacture, thinning instructions, application instructions and the SDS for the material.

C. Worker Protection: Before beginning work with any material for which an SDS has been submitted, provide workers with any required personal protective equipment. The required personal protective equipment shall be used whenever exposure to the material might occur. In addition to OSHA/specification requirements for respiratory protection, a paint pre-filter and an organic vapor cartridge, at a minimum, shall be used in addition to the HEPA filter when an

organic solvent based encapsulant or other solvent is used. The CPIH/CIH shall be responsible for provision of adequate respiratory protection. Note: Flammable and combustible encapsulants or solvents shall not be used, unless authorized in writing by the VA.

D. Encapsulation of Scratch Coat Plaster or Piping:
   1. Apply two coats of lockdown encapsulant to the scratch coat plaster or piping after all ACM has been removed. Apply in strict accordance with the manufacturer's instructions. Any deviation from the instructions must be approved by the VA's representative in writing prior to commencing the work.
   2. Apply the lockdown encapsulant with an airless sprayer at a pressure and using a nozzle orifice as recommended by the manufacturer. Apply the first coat while the scratch coat is still damp from the asbestos removal process, after passing the visual inspection. If the surface has been allowed to dry, wet wipe or HEPA vacuum prior to spraying with encapsulant. Apply a second coat over the first coat in strict conformance with the manufacturer's instructions. Color the lockdown encapsulant and contrast the color in the second coat so that visual confirmation of completeness and uniform coverage of each coat is possible. Adhere to the manufacturer's instructions for coloring. At the completion of the encapsulation, the surface must be a uniform third color produced by the mixture.

E. Sealing Exposed Edges: Seal edges of ACM exposed by removal work which is inaccessible, such as a sleeve, wall penetration, etc., with two coats of bridging encapsulant. Prior to sealing, permit the exposed edges to dry completely to permit penetration of the bridging encapsulant. Apply in accordance with 3.3.4 (B).

3.4 DISPOSAL OF ACM WASTE MATERIALS

A. General: Dispose of waste ACM and debris which is packaged in accordance with these specifications, in accordance with OSHA, EPA, State, Local and DOT requirements. The landfill requirements for packaging must also be met. Transport will be in compliance with 49 CFR 171-180 regulations. Disposal shall be done at an approved landfill. Disposal of non-friable ACM shall be done in accordance with applicable regulations.

B. Procedures:
   1. The VA must be notified at least 24 hours in advance of any waste removed from the containment.
   2. Asbestos waste shall be packaged and moved through the W/EDF into a covered transport container in accordance with procedures is this specification. Waste shall be double-bagged and wetted with amended water prior to disposal. Wetted waste can be very heavy. Bags shall not be overfilled. Bags shall be evacuated with HEPA vacuum and securely sealed to prevent accidental opening and/or leakage. The top shall be tightly twisted, and goose necked prior to tightly sealing with at least three wraps of duct tape. Ensure that unauthorized persons do not have access to the waste material once it is outside the regulated area. All

transport containers must be covered at all times when not in use. NESHAP signs must be on containers during loading and unloading. Material shall not be transported in open vehicles. If drums are used for packaging, the drums shall be labeled properly and shall not be re-used.

3. Waste Load Out: Waste load out shall be done in accordance with the procedures in W/EDF Decontamination Procedures. Sealed waste bags shall be decontaminated on exterior surfaces by wet cleaning and HEPA vacuuming before being placed in the second waste bag and sealed, which then must also be wet wiped and HEPA vacuumed.
4. Asbestos waste with sharp edged components, i.e., nails, screws, lath, strapping, tin sheeting, jacketing, metal mesh, etc., which might tear poly bags shall be wrapped securely in burlap before packaging and, if needed, use a poly lined fiber drum as the second container, prior to disposal.

3.5 PROJECT DECONTAMINATION

A. General:
   1. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.
   2. If the asbestos abatement work is in an area which was contaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal and cleanings of the surfaces of the regulated area after the primary barrier removal.
   3. If the asbestos abatement work is in an area which was uncontaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal, thus preventing contamination of the building when the regulated area critical barriers are removed.

B. Regulated Area Clearance: Clearance air testing and other requirements which must be met before release of the Contractor and re-occupancy of the regulated area space are specified in Final Testing Procedures.

C. Work Description: Decontamination includes the clearance air testing in the regulated area and the decontamination and removal of the enclosures/facilities installed prior to the abatement work including primary/critical barriers, PDF and W/EDF facilities, and negative pressure systems.

D. Pre-Decontamination Conditions:
   1. Before decontamination starts, all ACM waste from the regulated area shall be collected and removed, and the loose 6-mil layer of poly removed while being adequately wetted with amended water and disposed of along with any gross debris generated by the work.
   2. At the start of decontamination, the following shall be in place:
      a. Primary barriers consisting of 2 layers of 6-mil poly on the floor and 4 mil poly on the walls.
      b. Critical barriers consisting of 2 layers of 6-mil poly which is the sole barrier between the regulated area and openings to the rest of the building or outside.

c. Decontamination facilities for personnel and equipment in operating condition and the negative pressure system in operation.

E. First Cleaning: Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and HEPA vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications. The negative pressure system shall remain in operation during this time. Additional cleaning(s) may be needed as determined by the CPIH/VPIH/CIH.

F. Pre-Clearance Inspection and Testing: The CPIH/CIH and VPIH/CIH will perform a thorough and detailed visual inspection at the end of the cleaning to determine whether there is any visible residue in the regulated area. If the visual inspection is acceptable, the CPIH/CIH will perform pre-clearance sampling using aggressive clearance as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). If the sampling results show values below 0.01 f/cc, then the Contractor shall notify the VA's representative of the results with a brief report from the CPIH/CIH documenting the inspection and sampling results and a statement verifying that the regulated area is ready for lockdown encapsulation. The VA reserves the right to utilize their own VPIH/CIH to perform a pre-clearance inspection and testing for verification.

G. Lockdown Encapsulation of Abated Surfaces: With the express written permission of the VA's representative, perform lockdown encapsulation of all surfaces from which asbestos was abated in accordance with the procedures in this specification. Negative pressure shall be maintained in the regulated area during the lockdown application.

3.6 FINAL VISUAL INSPECTION AND AIR CLEARANCE TESTING

A. General: Notify the VA representative 24 hours in advance for the performance of the final visual inspection and testing. The final visual inspection and testing will be performed by the VPIH/CIH starting after the final cleaning.

B. Final Visual Inspection: Final visual inspection will include the entire regulated area, the PDF, all poly sheeting, seals over HVAC openings, doorways, windows, and any other openings. If any debris, residue, dust or any other suspect material is detected, the final cleaning shall be repeated at no additional cost to the VA. Dust/material samples may be collected and analyzed at no additional cost to the VA at the discretion of the VPIH/CIH to confirm visual findings. When the regulated area is visually clean the final testing can be done.

C. Final Air Clearance Testing:

1. After an acceptable final visual inspection by the VPIH/CIH, the VPIH/CIH will perform the final clearance testing. Air samples will be collected and analyzed in accordance with procedures for AHERA in this specification. If work is less than 260 lf/160 sf/35 cf, 5 PCM

samples shall be collected for clearance and a minimum of two field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA presented in this specification. If the release criteria are not met, the Contractor shall repeat the final cleaning and continue decontamination procedures until clearance is achieved. **All Additional inspection and testing costs will be borne by the Contractor**.

2. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

D. Final Air Clearance Procedures:

1. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured by the AHERA PCM protocol and < 70 AHERA asbestos structures per square millimeter (s/mm2) by AHERA TEM. No averaging of results will be used for this project. All five (5) TEM samples inside the regulated area shall be at or below 70 asbestos s/mm2 to satisfy the project final clearance criteria.
2. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures:
   a. Fibers Counted: “Fibers” referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.
   b. Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques except where soil is not encapsulated or enclosed. Samples will be collected on 0.8µ MCE filters for PCM analysis and 0.45µ MCE for TEM. A minimum of 3850 Liters of air using calibrated sampling pumps shall be collected for PCM samples and a minimum of 1,200 Liters of air using calibrated sampling pumps shall be collected for TEM clearance samples. Before pumps are started, initiate aggressive air mixing sampling as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). Air samples will be collected in areas subject to normal air circulation away from corners, obstructed locations, and locations near windows, doors, or vents. After air sampling pumps have been shut off, circulating fans shall be shut off. The negative pressure system shall continue to operate.
   c. Final clearance for soil that is not encapsulated, samples will be collected on 0.8µ MCE filters for PCM analysis and 0.45µ MCE filters for TEM. A minimum of 1,200 Liters of air using calibrated sampling pumps shall be collected for PCM samples and a minimum of 1,200 Liters of air using calibrated sampling pumps shall be collected for TEM clearance samples. Air clearance of work areas where contaminated soil has been removed is in

addition to the requirement for clearance by bulk sample analysis discussed within these specifications. There will be no aggressive air sampling for the clearance of soil due to the fact that aggressive air sampling may overload the cassettes.

d. Random bulk samples shall be collected from areas of soil which have been abated to ensure that the soil has been properly decontaminated. The total number of samples to be collected from the soil areas shall be; <1000 square feet of soil – 3 samples; >1000 to <5000 square feet of soil – 5 samples; and >5000 square feet of soil – 7 samples. The soil samples shall be collected in a statistically random manner and shall be analyzed by PLM method. The clearance level to determine the soil clean is <1 percent asbestos by weight as analyzed by PLM method. If this level is achieved, the soil areas shall be considered clear. If the levels are >1 percent asbestos, the areas shall be re-cleaned until the sample results are <1 percent.

E. Clearance Sampling Using PCM – Less than 260LF/160SF:

1. The VPIH/CIH will perform clearance samples as indicated by the specification.
2. The NIOSH 7400 PCM method will be used for clearance sampling with a minimum collection volume of 3850 Liters of air. A minimum of 5 PCM clearance samples shall be collected. All samples must be equal to or less than 0.01 f/cc to clear the regulated area.
3. Random bulk samples shall be collected from areas of soil which have been abated to ensure that the soil has been properly decontaminated. The total number of samples to be collected from the soil areas shall be; <1000 square feet of soil – 3 samples; >1000 to <5000 square feet of soil – 5 samples; and >5000 square feet of soil – 7 samples. The soil samples shall be collected in a statistically random manner and shall be analyzed by PLM method. The clearance level to determine the soil clean is <1 percent asbestos by weight as analyzed by PLM method. If this level is achieved, the soil areas shall be considered clear. If the levels are >1 percent asbestos, the areas shall be re-cleaned until the sample results are <1 percent.

F. Clearance Sampling Using TEM – Equal to or more than 260LF/160SF: TEM

1. Clearance requires 13 samples be collected; 5 inside the regulated area; 5 outside the regulated area; and 3 field blanks.
2. The TEM method will be used for clearance sampling with a minimum collection volume of 1200 Liters of air. A minimum of 13 clearance samples shall be collected. All samples must be equal to or less than 70 AHERA structures per square millimeter (s/mm2) AHERA TEM, no averaging of results for this specific project.

G. Laboratory Testing of PCM Clearance Samples: The services of an AIHA accredited laboratory will be employed by the VA to perform analysis for the PCM air samples. The accredited laboratory shall be successfully participating in the AIHA Proficiency Analytical Testing (PAT) program. Samples will be sent daily by the VPIH/CIH so that verbal/faxed reports can be received

within 24-36 hours. A complete record, certified by the laboratory, of all air monitoring tests and results will be furnished to the VA's representative and the Contractor.

H. Laboratory Testing of TEM Samples: Samples shall be sent by the VPIH/CIH to a NIST NVLAP accredited laboratory for analysis by TEM. The laboratory shall be successfully participating in the NIST Airborne Asbestos Analysis (TEM) program. Verbal/faxed results from the laboratory shall be available within 24-36 hours after receipt of the samples. A complete record, certified by the laboratory, of all TEM results shall be furnished to the VA's representative and the Contractor.

I. Laboratory Testing of Bulk Samples: Samples shall be sent by the VPIH/CIH or CPIH/CIH to a NIST NVLAP accredited laboratory for analysis by PLM. The laboratory shall successfully participate in the NIST NVLAP Bulk Asbestos Analysis (PLM) program. Verbal/faxed results from the laboratory shall be available within 24-36 hours after receipt of the samples. A complete record, certified by the laboratory, of all PLM and/or TEM results shall be furnished to the VA's representative and the Contractor.

3.7 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

A. Completion of Abatement Work:

1. After thorough decontamination, seal negative air machines with 2 layers of 6-mil poly and duct tape to form a tight seal at the intake/outlet ends before removal from the regulated area. Complete asbestos abatement work upon meeting the regulated area visual and air clearance criteria and fulfilling the following:

   a. Remove all equipment and materials from the project area.

   b. Dispose of all packaged ACM waste as required.

   c. Repair or replace all interior finishes damaged during the abatement work, as required.

   d. Fulfill other project closeout requirements as required in this specification.

B. Certificate of Completion By Contractor: The CPIH/CIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area.

C. Work Shifts: All work shall generally be done during administrative hours (8:00 AM to 4:30 PM) Monday - Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative.

D. Re-Insulation: If required as part of the contract, replace all asbestos containing insulation/fire-proofing with suitable non-asbestos material. Provide SDS's for all replacement materials in advance of installation for VA approval. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

ATTACHMENT #1
CERTIFICATE OF COMPLETION

DATE: _____ VA Project #:_____

PROJECT NAME:_____ Abatement Contractor:_____

VAMC/ADDRESS:_____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):
   which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer’s recommendations.

CPIH/CIH Signature/Date:_____

CPIH/CIH Print Name:_____

Abatement Contractor Signature/Date:_____

Abatement Contractor Print Name:_____

ATTACHMENT #2
CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME:_____DATE:_____

PROJECT ADDRESS:_____

ABATEMENT CONTRACTOR'S NAME:_____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate of worker’s acknowledgement you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32-hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

Physical Characteristics and Background Information on Asbestos
Potential Health Effects Related to Exposure to Asbestos
Employee Personal Protective Equipment
Establishment of a Respiratory Protection Program
State of the Art Work Practices
Personal Hygiene
Additional Safety Hazards
Medical Monitoring
Air Monitoring
Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature:_____

Printed Name:_____

Social Security Number (last 4 digits):_____

Witness:_____

ATTACHMENT #3
AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER:_____

VA MEDICAL FACILITY:_____

ABATEMENT CONTRACTOR'S NAME AND ADDRESS:_____

1. I verify that the following individual

Name:_____ Social Security Number:_____

who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.

Address:_____

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH:_____ Date:_____

Printed Name of CPIH/CIH:_____

Signature of Contractor:_____ Date:_____

Printed Name of Contractor:_____

ATTACHMENT #4
ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location:_____

VA Project #:_____

VA Project Description:_____

1. This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

2 I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

3. At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature_____Date_____

- - - E N D - - -

SECTION 02 82 13.13
GLOVEBAG ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. Contract Documents and Related Requirements: Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Asbestos Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred due to such action are also the responsibility of the Asbestos Abatement Contractor.

B. Extent of Work: Below is a brief description of the estimated quantities of asbestos containing materials to be abated by the Glovebag method. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy himself as to the actual quantities to be abated. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.

1. Removal, clean-up and disposal of asbestos-containing pipe insulation and fitting insulation and asbestos contaminated elements in appropriate regulated areas in the following approximate quantities and locations:

Material Description	Material Location(s)	Estimated Quantity
Pipe Insulation Including Mudded Elbows and Fittings	Associated with Hot Water and Steam Line in Basement of Building (Rooms: 1, 2,3 & 4)	200 Linear Feet (LF)

2. The General Contractor, not the asbestos abatement contractor, shall retain the services of an independent third-party consultant appropriately experienced and trained/licensed to conduct the onsite abatement VPIH/CIH monitoring services for the duration of the abatement as outlined in this specification. The abatement contractor shall be responsible for their own CPIH/CIH services outline in this specification.

C. Related Work:

1. Section 07 84 00, FIRESTOPPING
2. Section 02 41 00, DEMOLITION
3. Section 02 82 11, Traditional Asbestos Abatement
4. Section 02 82 13.19, Asbestos Floor Tile and Mastic Abatement
5. Section 02 82 13.31, Asbestos Transite-Type Abatement
6. Section 02 83 33.13, Lead-Based Paint Removal and Disposal
7. Division 09, FINISHES
8. Division 22, PLUMBING
9. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
10. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING
11. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING
12. Section 23 05 11, COMMON WORK RESULTS FOR HVAC
13. Section 22 05 33, HEAT TRACING FOR PLUMBING PIPING
14. Section 22 11 00, FACILITY WATER DISTRIBUTION
15. Section 22 13 00, FACILITY SANITARY SEWERAGE
16. Section 22 13 23, SANITARY WASTE INTERCEPTORS
17. Section 22 14 00, FACILITY STORM DRAINAGE
18. Section 22 66 00, CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES
19. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.
20. Section 23 11 23, FACILITY NATURAL-GAS PIPING.
21. Section 23 21 13, HYDRONIC PIPING
22. Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.
23. Section 23 31 00, HVAC DUCTS AND CASINGS
24. Section 23 37 00, AIR OUTLETS AND INLETS.

D. TASKS:

1. The work tasks are summarized briefly as follows:
   a. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, work-site preparations, emergency procedures arrangements, and Asbestos Hazard Abatement Plans for Glovebag asbestos abatement work.
   b. Abatement activities including removal, clean-up and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.
   c. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.

d. NOTE: The VPIH/CIH services shall be performed by an independent consultant hired by the GENERAL CONTRACTOR (NOT THE ABATEMENT CONTRACTOR) as further described in specification.

E. Abatement Contractor Use of Premises:

1. The Contractor and Contractor's personnel shall cooperate fully with the VA Representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.
2. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedures. VA Design and Construction Procedures drawings of partially occupied buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building; and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA Representative through the pre-abatement plan of action. The following limitations of use shall apply to existing facilities shown on drawings.

1.2 VARIATIONS IN QUANTITY

A. The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated, which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 10 percent) in quantities of ACM within the regulated area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered ACM and those prices shall be used for additional work required under the contractor.

1.3 STOP ASBESTOS REMOVAL

A. If the Contracting Officer; their field representative; the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal Stop Asbestos Removal Order, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed ACM. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as it is practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment.

Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor's competent person to the VA Contracting Office or field representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities if:

1. Airborne PCM analysis results equal to or greater than 0.01 f/cc above background levels inside the building but outside the regulated area;
2. breach or break in regulated area containment barrier(s);
3. less than –0.02-inch WCG pressure in the regulated area;
4. serious injury/death at the site;
5. fire/safety emergency at the site;
6. respiratory protection system failure;
7. power failure or loss or inadequate use of wetting agent; or
8. any visible emissions observed outside the regulated area; or
9. failure to follow project specification requirements.

1.4 DEFINITIONS

A. General: Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

B. Glossary:

Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, encapsulation, enclosure, demolition, and renovation activities related to asbestos containing materials (ACM).

Aerosol - Solid or liquid particulate suspended in air.

Adequately wet - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.

Aggressive method - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.

Aggressive air sampling - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.

AHERA - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.

Aircell - Pipe or duct insulation made of corrugated cardboard which contains asbestos.

Air monitoring - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 3, Fifth Edition is used to determine the fiber levels in air. For personal samples, area air samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis, the NIOSH Method 7402 Issue 2, Fourth Edition) can be used when it is necessary to confirm fibers counted by PCM as being asbestos. The AHERA TEM analysis may be used for background, area samples and clearance samples when required by this specification, or at the discretion of the VPIH/CIH as appropriate.

Air sample filter - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester membrane (MCE) for PCM (Phase Contrast Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.8 micron pore size) and MCE for TEM (Transmission Electron Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.45 micron pore size).

Amended water - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.

Asbestos - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.

Asbestos Hazard Abatement Plan (AHAP) - Asbestos work procedures required to be submitted by the contractor before work begins.

Asbestos-containing material (ACM) - Any material containing more than one percent of asbestos.

Asbestos contaminated elements (ACE) - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.

Asbestos-contaminated soil (ACS) – Soil found in the work area or in adjacent areas such as crawlspaces or pipe tunnels which is contaminated with asbestos-containing material debris and cannot be easily separated from the material.

Asbestos-containing waste (ACW) material - Asbestos-containing material or asbestos contaminated objects requiring disposal.

Asbestos Project Monitor – Some States require that any person conducting asbestos abatement air sampling, clearance inspections and clearance air sampling be licensed as an asbestos project monitor.

Asbestos waste decontamination facility - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of asbestos waste. Used as the exit for waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel.

Authorized person - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.

Authorized visitor - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA).

Barrier - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.

Containment Barrier - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.

Critical Barrier - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of 2-layers of 6-mil independently installed plastic sheeting (Polyethylene) secured in place at openings such as doors, windows, penetrations or any other opening into the regulated area.

Primary Barrier – Plastic barriers placed over critical barriers and exposed directly to abatement work or to secondary barrier.

Secondary Barrier - Any additional plastic barriers used to isolate and provide protection from debris during abatement work.

Breathing zone - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.

Bridging encapsulant - An encapsulant that forms a layer on the surface of the ACM.

Building/facility owner - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.

Bulk testing - The collection and analysis of suspect asbestos containing materials.

Certified Industrial Hygienist (CIH) - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.

Class I asbestos work - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).

Class II asbestos work - Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.

Clean room/Changing room - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.

Clearance sample - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's Professional Industrial Hygiene Consultant/Certified Industrial Hygienist (VPIH/CIH).

Closely resemble - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

Competent person - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control

strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.

Contractor's Professional Industrial Hygienist (CPIH/CIH) - The asbestos abatement contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of a PIH and may report to a certified industrial hygienist (CIH).

Count - Refers to the fiber count or the average number of fibers greater than five microns in length with a length-to-width (aspect) ratio of at least 3 to 1, per cubic centimeter of air.

Crawlspace – An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain asbestos materials and/or asbestos contaminated soil.

Decontamination area/unit - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

Demolition - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

Disposal bag - Typically 6-mil thick sift-proof, dustproof, leak-tight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.

Disturbance - Asbestos Operations and Maintenance Activities (OSHA Class III) that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag or waste bag, in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or disposal bag, which shall not exceed 60 inches in length or width.

Drum - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.

Employee exposure - The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.

Encapsulant - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.

Encapsulation - Treating ACM with an encapsulant.

Enclosure - The construction of an airtight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.

Equipment room - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

Fiber - A particulate form of asbestos, 5 microns or longer, with a length to width (aspect) ratio of at least 3 to 1.

Fibers per cubic centimeter (f/cc) - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.

Filter - Media used in respirators, vacuums, or other machines to remove particulate from air.

Firestopping - Material used to close the open parts of a structure in order to prevent a fire from spreading.

Friable asbestos containing material - Any material containing more than one (1) percent asbestos as determined using the method specified 40 CFR 763, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

Glovebag - Not more than a 60 x 60-inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.

High efficiency particulate air (HEPA) filter – An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

HEPA vacuum - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.

Homogeneous area - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.

HVAC - Heating, Ventilation and Air Conditioning

Industrial hygienist (IH) - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).

Industrial hygienist technician (IH Technician) - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned. Some States require that an industrial hygienist technician conducting asbestos abatement air sampling, clearance inspection and clearance air sampling be licensed as an asbestos project monitor.

Intact - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Lockdown - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.

National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA's rule to control emissions of asbestos to the environment (40 CFR Part 61, Subpart M).

Negative initial exposure assessment - A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL or Excursion Limit (EL).

Negative pressure - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02-inch water column gauge inside the negative pressure enclosure.

Negative pressure respirator - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.

Non-friable ACM - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Organic vapor cartridge - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.

Outside air - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.

Owner/operator - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

Penetrating encapsulant - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.

Permissible exposure limit (PEL) - The level of exposure OSHA allows for an 8-hour time weighted average. For asbestos fibers, the eight (8) hour time-weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit (EL) is 1.0 fibers per cubic centimeter (1 f/cc).

Personal protective equipment (PPE) – equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, fall protection, and respirators.

Personal sampling/monitoring - Representative air samples obtained in the breathing zone for one or more workers within the regulated area using a filter cassette and a calibrated air sampling pump to determine asbestos exposure.

Pipe tunnel – An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, debris or asbestos-contaminated soil.

Polarized light microscopy (PLM) - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type of asbestos present in a bulk sample.

Polyethylene sheeting - Strong plastic barrier material 4 to 6-mils thick, semi-transparent, flame retardant per NFPA 241.

Positive/negative fit check - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator respectively.

Presumed ACM (PACM) - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge, or should have known through the exercise of due diligence that other materials are ACM, they too must be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (k)(5).

Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH/CIH) or Contractor's PIH (CPIH/CIH).

Project designer - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Subpart E, Appendix C, Part I; (B)(5).

Assigned Protection factor - A value assigned by OSHA/NIOSH to indicate the expected protection provided by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.

Qualitative fit test (QLFT) - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.

Quantitative fit test (QNFT) - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.

Regulated area - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.

Removal - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.

Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.

Repair - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.

Shower room - The portion of the PDF where personnel shower before leaving the regulated area.

Supplied air respirator (SAR) - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-2018.

Surfacing ACM - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, decorative, fireproofing and other purposes.

Surfactant - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.

Thermal system ACM - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.

Transmission electron microscopy (TEM) - A microscopy method that can identify and count asbestos fibers.

VA Professional Industrial Hygienist (VPIH/CIH) – The Department of Veterans Affairs Professional Industrial Hygienist must meet the qualifications of a PIH and may report to a Certified Industrial Hygienist (CIH).

VA Representative - The VA official responsible for on-going project work.

VA Total – means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.

Visible emissions - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM/ACS or ACM waste material.

Waste/Equipment decontamination facility (W/EDF) – The area in which equipment is decontaminated before removal from the regulated area.

Waste generator - Any owner or operator whose act or process produces asbestos-containing waste material.

Waste shipment record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

Wet cleaning - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

C. Referenced Standards Organizations: See Section 01 42 19 REFERENCED STANDARDS.

1.5 APPLICABLE CODES AND REGULATIONS

A. General Applicability of Codes, Regulations, and Standards:

1. All work under this contract shall be done in strict accordance with all applicable Federal, State, and Local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.
2. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.
3. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system and/or the Contractor's on-site Field Office. These standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 may be made available electronically.

B. Asbestos Abatement Contractor Responsibility: The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE), respiratory protection, and respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Abatement Contractor will incur all costs of the CPIH/CIH, including all sampling/analytical costs to assure compliance with OSHA/EPA/State/Local requirements related to failure to comply with the regulations applicable to the work.

C. Federal Requirements: Federal requirements which govern some aspect of asbestos abatement include, but are not limited to, the following regulations.

1. Occupational Safety and Health Administration **(OSHA)**
   a. Title 29 CFR 1926.1101 - Construction Standard for Asbestos
   b. Title 29 CFR 1926 Subpart E - Personal Protective Equipment and Life Saving Equipment
   c. Title 29 CFR 1910.134 - Respiratory Protection
   d. Title 29 CFR 1926 - Construction Industry Standards

e. Title 29 CFR 1926.33 - Access to Employee Exposure and Medical Records

f. Title 29 CFR 1926.59 same as 1910.1200 - Hazard Communication

g. Title 29 CFR 1926 Subpart C – General Safety and Health Provisions and Subpart D – Occupational Health and Environmental Controls

2. Environmental Protection Agency **(EPA)**

a. 1.40 CFR 61 Subpart M - National Emission Standard for Hazardous Air Pollutants - Asbestos

b. 2.40 CFR 763.80 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos Hazard Abatement Reauthorization Act (ASHARA)

3. Department of Transportation **(DOT)**

b. Title 49 CFR 171 - 180 – Transportation

D. State Requirements:

1. State requirements that apply to the asbestos abatement work, disposal, clearance, etc., include, but are not limited to, the following:

The Ohio Administrative Code (OAC) 3745-20 contains regulations for controlling asbestos emissions from demolition and renovation projects. Ohio's regulations are consistent with U.S. EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) regarding asbestos. The regulations require that contractors do several things, such as provide a notification, conduct thorough inspections to determine the presence of asbestos, follow specific work practices, and ensure proper disposal of asbestos-containing material.

The Ohio EPA asbestos program licenses and certifies companies and persons directly involved with the asbestos abatement industry. OAC 3745-22 contains regulations pertaining to contractors performing asbestos removal projects, project supervisors, project designers, workers removing asbestos, persons inspecting buildings for asbestos-containing materials and developing plans to manage asbestos found in a facility, persons conducting air sampling for asbestos and the companies that provide required asbestos training. The asbestos program ensures the safety and quality of asbestos services by requiring persons to take approved training that is specific to the asbestos related activities in which they will be involved and by inspecting/auditing the activities of the program participants.

E. Local Requirements:

1. If Local requirements are more stringent than Federal or State standards, the local standards are to be followed.

2. Montgomery County, Ohio Regulation 150.

F. Standards:

1. Standards which govern asbestos abatement activities include, but are not limited to, the following:
   b. American National Standards Institute (ANSI/ASSP) Z9.2-2018 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI/ASSE Z88.2-2015 - Practices for Respiratory Protection.
   c. Underwriters Laboratories (UL) 586-2009 - UL Standard for Safety of HEPA filter Units, 9th Edition; ANSI Approval 2017-12-19.
2. Standards which govern encapsulation work include, but are not limited to, the following:
   b. American Society for Testing and Materials International (ASTM).
3. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
   b. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
   c. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
   d. NFPA 101 - Life Safety Code.

G. EPA Guidance Documents:
1. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024.
2. Asbestos Waste Management Guidance EPA 530-SW-85-007.
3. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001.
4. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990.

H. Notices:
1. State and Local agencies: Send written notification as required by state and local regulations including the local fire department prior to beginning any work on ACM as follows:
   Submit prior abatement notification to the Ohio EPA at least 10-business days prior to start of work. Ohio EPA notifications can be completed online at www.ebiz.epa.ohio.gov.
2. Copies of notifications shall be submitted to the VA for the facility's records in the same time frame notification are given to EPA, State, and Local authorities.

I. Permits/Licenses: The contractor shall apply for and have all required permits and licenses to perform asbestos abatement work as required by Federal, State, and Local regulations prior to beginning any work on ACM as follows.

J. Posting and Filing of Regulations: Maintain two (2) copies of applicable Federal, State, and Local regulations. Post one copy of each at the regulated area where workers will have daily access to the regulations and keep another copy in the Contractor's office.

K. VA Responsibilities Prior to Commencement of Work:

1. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment, and personal possessions to avoid unauthorized access into the regulated area. Note: **Notification of adjacent personnel is required by OSHA in 29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area.**
2. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized, calibration data and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

L. Emergency Action Plan and Arrangements:

1. An Emergency Action Plan shall be developed by prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1926, Subpart C, Standard 1926.35 Employee Emergency Action Plans.
2. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
3. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.
4. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.
5. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
   b. For non-life-threatening situations - employees injured or otherwise incapacitated shall be decontaminated following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
   c. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, medical personnel shall remove them from the regulated area if back or neck injury is present, and secure proper medical treatment.
6. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
7. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-

threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.

8. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the Asbestos Hazard Abatement Plans during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

M. Pre-Construction Meeting:

1. Prior to commencing the work, the Contractor shall meet with the VPIH/CIH to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:
   b. Proof of Contractor licensing.
   c. Proof the Competent Person is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person shall also be presented.
   d. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
   e. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.
   f. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.1101 (m).
   g. Current fit tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.
   h. A copy of the Contractor's Asbestos Hazard Abatement Plan. In these procedures, the following information must be detailed, specific for this project. A copy of the Contractor's Asbestos Hazard Abatement Plan (AHAP) for Class I Glovebag Asbestos Abatement. In these procedures, the following information must be detailed, specific for this project.
      1) Regulated area preparation procedures;
      2) Notification requirements procedure of Contractor as required in 29 CFR 1926.1101 (d) Multi-Employer Worksites;
      3) If required, decontamination area set-up/layout and decontamination procedures for employees;
      4) Glovebag abatement methods/procedures and equipment to be used; and
      5) Personal protective equipment to be used
2. At this meeting the Contractor shall provide all submittals as required.

3. Procedures for handling, packaging and disposal of asbestos waste.
4. Emergency Action Plan and Contingency Plan Procedures.

1.6 PROJECT COORDINATION

A. The following are the minimum administrative and supervisory personnel necessary for coordination of the work.

1. Personnel

a. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.

b. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA Representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; last four digits of social security number; qualifications; accreditation card with color picture if required by State; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.

c. Minimum qualifications for Contractor and assigned personnel are:

1) The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of Federal (and State or Local as applicable) EPA and OSHA asbestos regulations in the past three (3) years; has adequate liability/occurrence insurance for asbestos work as required by the State; is licensed in applicable State; has adequate and qualified personnel available to complete the work; has comprehensive Asbestos Hazard Abatement Plans (AHAPs) for asbestos work; and has adequate materials, equipment and supplies to perform the work.

2) The Competent Person has three (3) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.

3) The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have three (3) years of monitoring experience and supervision of asbestos abatement projects; has

participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.

4) The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the Asbestos Hazard Abatement Plans of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; has certificate of training/current refresher and State accreditation/license.

2. All personnel shall be in compliance with OSHA construction safety training as applicable and submit certification.

1.7 RESPIRATORY PROTECTION

A. General - Respiratory Protection Program: The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.134. ANSI Standard Z88.2-2015 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c) - Respiratory Protection Program. Respiratory Protection Program Coordinator: The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years of experience coordinating RPP of similar size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

B. Selection and Use of Respirators: The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit or in the onsite Contractor’s office, for reference by employees or authorized visitors.

C. Minimum Respiratory Protection: Minimum respiratory protection shall be a ½-mask negative pressure air purifying respirator equipped with P100 filters, provided personal air samples in the workplace remain at or below 0.1 f/cc, determined as an 8-hour TWA. Full face powered air purifying respirator equipped with P100 filters shall be required until Contractor demonstrates that personal air samples are at or below 0.1 f/cc, determined as an 8-hour TWA. A higher level of respiratory protection shall be required, if fiber levels exceed 1 f/cc as an 8-hour TWA, inside the regulated work area. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h)

and 29 CFR 1910.134 (d)(3)(i)(A) Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

D. Medical Written Opinion: No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination, they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

E. Respirator Fit Test: All personnel wearing respirators shall have a current quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Fit tests shall be done for PAPR's which have been put into a failure mode.

F. Respirator Fit Check: The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from entering the regulated area until resolution of the problem.

G. Maintenance and Care of Respirators: The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) maintenance and care of respirators.

1.8 WORKER PROTECTION

A. Training of Abatement Personnel: Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Initial training certificates and current refresher and accreditation proof must be submitted for each person working at the site.

B. Medical Examinations: Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion that the person has been evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

C. Personal Protective Equipment: Provide whole body clothing, head coverings, foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

D. Regulated Area Entry Procedure: The Competent Person shall ensure that each time workers enter the regulated area; they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment

E. Decontamination Procedure: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.

1. When exiting the regulated area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.
2. Still wearing the respirator and completely naked, proceed to the shower. Showering is MANDATORY. Care must be taken to follow reasonable procedures in removing the respirator to avoid inhaling asbestos fibers while showering. The following procedure is required as a minimum:
   a. Thoroughly wet body including hair and face. If using a PAPR hold blower above head to keep filters dry.
   b. With respirator still in place, thoroughly decontaminate body, hair, respirator face piece, and all other parts of the respirator except the blower and battery pack on a PAPR. Pay particular attention to cleaning the seal between the face and respirator facepiece and under the respirator straps.
   c. Take a deep breath, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.
3. Carefully decontaminate the facepiece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) carefully decontaminate battery pack with a wet rag being cautious of getting water in the battery pack thus preventing destruction. **(THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!)**
4. Shower and wash body completely with soap and water. Rinse thoroughly.
5. Rinse shower room walls and floor to drain prior to exiting.
6. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

F. Regulated Area Requirements: The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for Class I Glovebag regulated areas at 29 CFR 1926.1101 (e), 29 CFR 1926.1101 (g)(1)(i)(ii)(iii), 29 CFR 1926.1101 (g)(5)(ii)(iii)(iv) are met. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

A. Description: Provide each regulated area with separate personnel decontamination facilities (PDF) and waste/equipment decontamination facilities (W/EDF). Ensure that the PDF are the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the W/EDF.

B. General Requirements: All personnel entering or exiting a regulated area must go through the PDF and shall follow the requirements at 29 CFR 1926.1101 (j)(1) and these specifications. All waste, equipment and contaminated materials must exit the regulated area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF must be constructed of a minimum of 3-layers of 6-mil opaque fire-retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 3-layers of 6-mil poly shall also be used to cover the floor under the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

C. Temporary Facilities to the PDF and W/EDF: The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention must be provided at the point of connection to the VA system. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141(d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel equipped with GFCI protection for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50-foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70˚F throughout the PDF and W/EDF.

D. Personnel Decontamination Facility (PDF): The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room. The PDF must be sized to accommodate the number of personnel scheduled for the project. The shower room, located in the center of the PDF, shall be fitted with as many portable showers as necessary to insure all employees can complete the entire decontamination procedure within 15 minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.

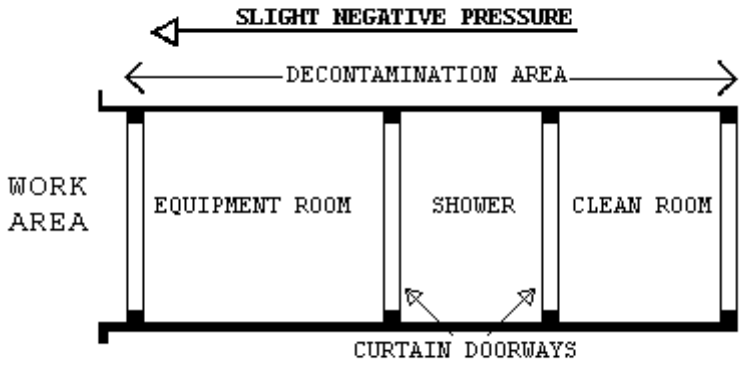
1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3—layers of 6-mil opaque fire-retardant poly to provide an airtight room. Provide a minimum of 2 - 900 mm (3 foot) wide 6-mil poly opaque fire-retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower

room of the PDF. The floor of the clean room shall be maintained in a clean, dry and sanitary condition. Shower overflow shall not be allowed into the clean room. Provide 1 storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Male/Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male/female can enter or exit the PDF during his/her stay in the PDF.

2. Shower Room: The Competent Person shall assure that the shower room is a completely watertight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using airtight walls made from at least 3-layers of 6-mil opaque fire-retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Wastewater will be pumped to a drain after being filtered through a minimum of a 100-micron sock in the shower drain; a 20-micron filter; and a final 5 micron filter. Filters will be changed a minimum of once per day or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste. The Competent Person shall provide a decontamination area at the outer perimeter of the regulated work area where the employees will decontaminate the outer protective suit and respirator by wet wiping and HEPA vacuuming.
3. Equipment Room: The Competent Person shall provide an equipment room which shall be an airtight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The equipment room shall be separated from the regulated area by a minimum 3-foot-wide door made with 2-layers of 6-mil opaque fire-retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by airtight walls and ceiling constructed of a minimum of 3-layers of 6-mil opaque fire-retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional

loose layer of 6-mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area.

4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of 2-layers of 6-mil opaque fire-retardant poly.

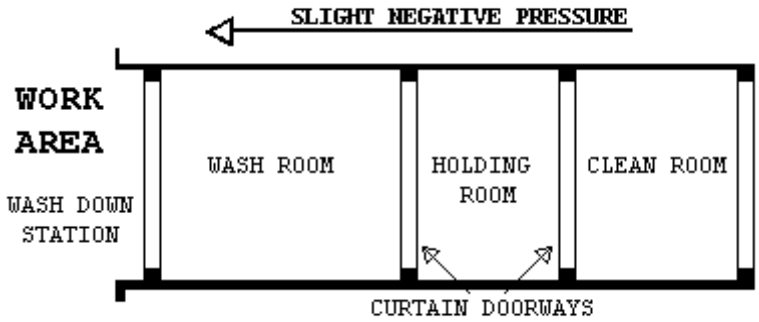


E. Waste/Equipment Decontamination Facility (W/EDF)

1. The Competent Person shall provide a W/EDF consisting of a washroom, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:
   a. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Washroom as an equipment bag and container cleaning station.
   b. Washroom: Provide a washroom for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the washroom using 50 x 100 mm (2 inches x 4 inches) wood framing and 3-layers of 6-mil fire retardant poly. Locate the washroom so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the washroom shall be constructed of 2-layers of 6-mil fire retardant poly.
   c. Holding Room: Provide a holding room as a drop location for bagged materials passed from the washroom. Construct the holding room using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and 3-layers of 6-mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the washroom to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of 2-layers of 6-mil fire retardant poly.

d. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 inches x 4 inches wood framing or approved equivalent and 2-layers of 6-mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of 2-layers of 6-mil fire retardant poly. When a negative pressure differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.

e. The W/EDF shall be as follows: Washroom leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



F. Waste/Equipment Decontamination Procedures: At the washdown station in the regulated area, thoroughly wet wipe/clean contaminated equipment and/or sealed polyethylene bags and pass into Washroom after visual inspection. When passing anything into the Washroom, close all doorways of the W/EDF, other than the doorway between the washdown station and the Washroom. Keep all outside personnel clear of the W/EDF. Once inside the Washroom, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. At no time shall personnel from the clean side be allowed to enter the Washroom.

PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT

2.1 MATERIALS AND EQUIPMENT

A. General Requirements (all abatement projects): Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's Representative.

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mils. For floors and all other uses, sheeting of at least 6-mils shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
6. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape, poly tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or approved equivalent procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
7. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6-mil fire retardant poly.
8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and wastewater filtration system shall be provided by the Contractor.
9. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
10. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
11. Disposal bags – 2-layers of 6-mil poly for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
12. The VA shall be provided an advance copy of the Safety Data Sheets (SDS) as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the

pre-project submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.

13. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal, State and Local regulations shall be posted in the Clean Room.
14. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d)

2.2 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA

A. General: Using critical barriers, seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All horizontal surfaces in the regulated area must be covered with 2-layers of 6-mil fire retardant poly to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated, immediately stop work and clean up the contamination at no additional cost to the Government. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 2.2.7; FIRESTOPPING.

B. Preparation Prior to Sealing the Regulated Area: Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. Remove all uncontaminated removable furniture, equipment and/or supplies from the regulated area before commencing work, or completely cover with 2-layers of 6-mil fire retardant poly sheeting and secure with duct tape. Lock out and tag out any HVAC systems in the regulated area.

C. Controlling Access to the Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF), if required. All other means of access shall be eliminated, and OSHA Danger demarcation signs posted as required by OSHA. If the regulated area is adjacent to or within view of an occupied area, provide a visual barrier of 6-mil opaque fire-retardant poly sheeting to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid.

D. Critical Barriers: Completely separate any openings into the regulated area from adjacent areas using fire retardant poly at least 6-mils thick and duct tape. Individually seal with 2-layers of independently installed 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects in the regulated area. Heat must be shut off any objects covered with poly.

E. Secondary Barriers: A loose layer of 6-mil fire retardant poly shall be used as a drop cloth to protect the floor/horizontal surfaces from debris generated during the Glovebag abatement. This layer shall be replaced as needed during the work.

F. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. If the affected area cannot be added to the regulated area, decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.

G. Firestopping:

1. Through penetrations caused by cables, cable trays, pipes, sleeves must be fire-stopped with a fire-rated firestop system providing an airtight seal.
2. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The Contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA Representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.
3. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed

2.3 MONITORING, INSPECTION AND TESTING

A. General:

1. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the employee exposure to asbestos must not exceed 0.1 fibers per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples inside the building, but outside the regulated area. Inside the building, but outside the regulated area air samples shall be collected at the boundary of the regulated area and/or Clean Room of the PDF, at the approximate location of HEPA exhaust discharge (if used), and at a minimum of three (3) locations in areas immediately outside the regulated work area to satisfy this specification. Additional inspection and testing requirements are also indicated in other parts of this specification.
2. The General Contractor will employ an independent industrial hygienist (VPIH/CIH) consultant to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA

patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the General Contractor including any repeat of final inspection and testing that may be required due to unsatisfactory initial results.

3. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's Representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH/CIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's Representative.

B. Scope of Services of the VPIH/CIH Consultant:

1. The purpose of the work of the VPIH/CIH is to: Assure quality; resolve problems; and prevent the spread of contamination beyond the regulated area. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:
   a. Task 1: May establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
   b. Task 2: Perform representative air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
   c. Task 3: Perform unannounced visits inside the regulated work area to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.

d. Task 4: Provide support to the VA Representative such as evaluation of submittals from the Contractor, resolution of unforeseen developments, etc.

e. Task 5: Perform final inspection and testing of a decontaminated regulated area or building at the conclusion of the abatement and clean-up work to certify compliance with all regulations and the VA requirements/specifications.

f. Task 6: Issue final abatement monitoring project report.

2. All data, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.

3. The monitoring and inspection results of the VPIH/CIH may be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

4. Monitoring, Inspection and Testing by Abatement Contractor CPIH/CIH: The Contractor's CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor's personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH Technician shall have successfully completed a NIOSH 582 Course or equivalent and provide documentation. The IH Technician shall participate in the AIHA Asbestos Analysis Registry or participate in the Proficiency Analytical Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and area samples and have experience in substantially similar projects in size and scope. The analytical laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT and approved by the VA prior to start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for personal and area air monitoring for asbestos in 29 CFR 1926.1101(f), (g) and Appendix A. This log shall be made available to the VA Representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each representative job being done in the regulated

area, i.e., removal, wetting, clean-up, and load-out. No fewer than two (2) personal air samples or 25% of representative workforce per shift shall be collected, whichever is greater, in the regulated area; a minimum of three (3) area air samples at locations inside the building but immediately outside the regulated work area; one (1) area air sample shall be collected daily at the boundary of the regulated area and/or Clean Room of the PDF; and one (1) area air sample shall be collected daily at the approximate location of HEPA exhaust discharge, if used. In addition to the continuous monitoring required, the CPIH/CIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities. Additionally, the CPIH/CIH will monitor and record pressure readings within the containment daily with a minimum of two readings at the beginning and at the end of a shift, and submit the data in the daily report. Pressure readings with the containment may be omitted if negative pressure Glovebag procedures are used.

2.4 ASBESTOS HAZARD ABATEMENT PLAN

A. The Contractor shall have established Asbestos Hazard Abatement Plan (AHAP) in printed form and loose-leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the ways and procedures to be followed during all phases of the work by the Contractor's personnel. The AHAP must be modified as needed to address specific requirements of the project. The AHAP shall be submitted for review and approval prior to the start of any abatement work. The minimum topics and areas to be covered by the AHAP(s) are:

1. Minimum Personnel Qualifications
2. Contingency Plans and Arrangements
3. Security and Safety Procedures
4. Respiratory Protection/Personal Protective Equipment Program and Training
5. Medical Surveillance Program and Recordkeeping
6. Regulated Area Requirements for Glovebag Abatement
7. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF) or approved equivalent.
8. Monitoring, Inspections, and Testing
9. Removal Procedures for Piping ACM Using the Glovebag Method
10. Disposal of ACM waste
11. Regulated Area Decontamination/Clean-up
12. Regulated Area Visual and Air Clearance
13. Project Completion/Closeout

2.5 SUBMITTALS

A. Pre-Start Meeting Submittals:

1. Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:
   a. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
   b. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
   c. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.
   d. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
      1) Supplied air system, negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
      2) Wastewater filtration system, shower system, containment barriers.
      3) Encapsulants, surfactants, handheld sprayers, airless sprayers, Glovebags, and fire extinguishers.
      4) Respirators, water filtration system, shower system, containment barriers equipment.
      5) Fire safety equipment to be used in the regulated area.
   e. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
   f. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.
   g. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. Area or clearance air monitoring shall be conducted in accordance with EPA AHERA protocols.

h. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.

1) Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project; Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; and Completion Date.

2) List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; and Resolution.

3) List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal, State, Local NESHAP), penalties, and legal actions taken against the company including the company's officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.

i. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulations. Submit the phone number and doctor/clinic/hospital used for medical evaluations.

1) CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; medical opinion; and current respirator fit test.

2) Competent Person(s)/Supervisor(s): Number; names; last four digits of social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

3) Workers: Numbers; names; last four digits of social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

j. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of AHAP(s) incorporating the requirements of this specification; information on who

provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and Asbestos Hazard Abatement Plans; copies of monitoring results of the five referenced projects listed and analytical method(s) used.

k. Rented equipment must be decontaminated prior to returning to the rental agency.

l. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all SDS, and application instructions.

B. Submittals During Abatement:

1. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; representative air monitoring and results/TWAs/ELs. Submit this information daily to the VA's Representative.

2. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.

a. Removal of any poly barriers and/or failure of negative pressure Glovebags.

b. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant.

c. Packaging and removal of ACM waste from regulated area.

d. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's Representative on a weekly basis.

C. Submittals at Completion of Abatement: The CPIH/CIH shall submit a project report consisting of the daily logbook requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area samples must be submitted. The VA Representative will retain the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

2.6 ENCAPSULANTS

A. Types of Encapsulants:

1. The following four types of encapsulants must comply with performance requirements as stated in paragraph 2.6.2:

a. Removal encapsulant - used as a wetting agent to remove ACM.

b. Bridging encapsulant - provides a tough, durable coating on ACM.

c. Penetrating encapsulant - penetrates/encapsulates ACM at least 13 mm (1/2 inch).

d. Lockdown encapsulant - seals microscopic fibers on surfaces after ACM removal.

B. Performance Requirements:

1. Encapsulants shall meet the latest requirements of EPA; shall not contain toxic or hazardous substances; or solvents; and shall comply with the following performance requirements:

a. General Requirements for all Encapsulants:

1) ASTM E84: Flame spread of 25; smoke emission of 50.

2) University of Pittsburgh Protocol: Combustion Toxicity; zero mortality.

3) ASTM C732: Accelerated Aging Test; Life Expectancy - 20 years.

4) ASTM E96: Permeability - minimum of 0.4 perms.

b. Bridging/Penetrating Encapsulants:

1) ASTM E736: Cohesion/Adhesion Test - 24 kPa (50 pounds/square foot).

2) ASTM E119: Fire Resistance - 3 hours (Classified by UL for use on fibrous/cementitious fireproofing).

3) ASTM D2794: Gardner Impact Test; Impact Resistance - minimum 11.5 kg-mm (43 in/lb).

4) ASTM D522: Mandrel Bend Test; Flexibility - no rupture or cracking

c. Lockdown Encapsulants:

1) ASTM E119: Fire resistance - 3 hours (tested with fireproofing over encapsulant applied directly to steel member).

2) ASTM E736: Bond Strength - 48 kPa (100 pounds/square foot) (test compatibility with cementitious and fibrous fireproofing).

3) In certain situations, encapsulants may have to be applied to hot pipes/equipment. The encapsulant must be able to withstand high temperatures without cracking or creating any noxious gaseous or vapors during or after application.

2.7 CERTIFICATES OF COMPLIANCE

A. The Contractor shall submit to the VA Representative certification from the manufacturer indicating compliance with performance requirements for encapsulants when applied according to manufacturer recommendations.

B. Recyclable Protective Clothing: If recyclable clothing is provided, all requirements of EPA, DOT and OSHA shall be met.

PART 3 - EXECUTION

3.1 REGULATED AREA PREPARATIONS

A. Site Security:

1. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and representatives, State and Local inspectors, and any other designated

individuals. A list of authorized personnel shall be established prior to commencing the project and shall be posted in the clean room of the decontamination unit or in a designated area located immediately outside of the regulated area established for Glovebag removal activities.

2. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent Person shall immediately require any unauthorized person to leave the regulated area and then notify the VA Contracting Officer or VA Representative using the most expeditious means.
3. A logbook shall be maintained in the clean room of the decontamination unit or in a designated area located immediately outside of the regulated area established for Glovebag removal activities. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.
4. Access to the regulated area shall be through a single decontamination unit or in an area designated by the Competent Person for Glovebag removal activities. All other access (doors, windows, hallways, etc.) shall be sealed or locked to prevent entry to or exit from the regulated area. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall not be locked from the inside; however, they shall be sealed with poly sheeting and taped until needed. In any situation where exposure to high temperatures which may result in a flame hazard, fire retardant poly sheeting must be used.
5. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24-hour security system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.
6. The Contractor will have the VA's assistance in notifying adjacent personnel of the presence, location and quantity of ACM in the regulated area and enforcement of restricted access by the VA's employees.
7. The regulated area shall be locked during non-working hours and secured by VA Representative or Competent Person. The VA Police shall be informed of asbestos abatement regulated areas to provide security checks during facility rounds and emergency response.

B. OSHA Danger Signs: Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area where airborne concentrations of asbestos may exceed ambient background levels. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and

take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.

C. Shut Down - Lock Out Electrical: Shut down and lock out/tag out electric power to the regulated area. Provide temporary power and lighting. Ensure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code requirements and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.

D. Shut Down - Lock Out HVAC: Shut down and lock out/tag out heating, cooling, and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Investigate the regulated area and agree on pre-abatement condition with the VA's Representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2-ayers of independently installed 6-mil poly. Also, seal any seams in system components that pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil poly disposal bags for disposal as asbestos waste.

E. Containment Barriers and Coverings for the Regulated Area:

1. General: Seal off any openings at the perimeter of the regulated area with critical barriers to completely isolate the regulated area and to contain all airborne asbestos contamination created by the abatement activities. Should the adjacent area past the regulated area become contaminated due to improper work activities, the Contractor shall suspend work inside the regulated area, continue wetting, and clean the adjacent areas in accordance with procedures described in these specifications. Any and all costs associated with the adjacent area cleanup shall not be borne by the VA.
2. Preparation Prior to Sealing Off: Place all materials, equipment and supplies necessary to isolate the regulated area inside the regulated area. Remove all movable material/equipment as described above and secure all unmovable material/equipment as described above. Properly secured material/ equipment shall be considered to be outside the regulated area.
3. Controlling Access to the Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF) or in an area designated by the Competent Person for Glovebag removal activities. All other means of access shall be eliminated, and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to, or within view of an occupied area, provide a visual barrier of 6-mil opaque fire-retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.
4. Critical Barriers: The regulated area must be completely separated from the adjacent area(s) and the outside by at least 2-layers of independently installed 6-mil fire retardant poly and duct tape/spray adhesive. Individually seal all supply and exhaust ventilation openings, lighting fixtures, clocks, doorways, windows, convectors, speakers, and other openings into

the regulated area with 2-layers of 6-mil fire retardant poly, and taped securely in place with duct tape/spray adhesive. Critical barriers must remain in place until all work and clearances have been completed. Light fixtures shall not be operational during abatement. Auxiliary lighting shall be provided. If needed, provide plywood squares 6 inches x 6 inches x 3/8 inch (150mm x 150mm x 18mm) or approved equivalent, held in place with 6d smooth masonry/galvanized nail or approved equivalent driven through the center of the plywood square and duct tape on the poly so as to clamp the poly to the wall/surface. Locate plywood squares at each end, corner, and 4 feet (1200mm) maximum on centers

5. Extension of the Regulated Area: If the regulated area barrier is breached in any manner that could allow the passage of asbestos fibers or debris, the Competent Person shall immediately stop work, continue wetting, and proceed to extend the regulated area to enclose the affected area as per procedures described in this specification. If the affected area cannot be enclosed, decontamination measures and cleanup shall start immediately. All personnel shall be isolated from the affected area until decontamination/cleanup is completed as verified by visual inspection and air monitoring. Air monitoring at completion must indicate background levels.
6. Floor Barriers: All floors within 10 feet of Glovebag work shall be covered with 2-layers of 6-mil fire retardant poly. If no breach occurs during the Glovebag abatement operation, these layers of 6—mil fire retardant poly may be reused

F. Sanitary Facilities: The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.

G. Pre-Cleaning:

1. Pre-Cleaning Movable Objects:
   a. The VA will provide water for abatement purposes. The Contractor shall connect to the existing VA system. The service to the shower(s), if used, shall be supplied with backflow prevention.
   b. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. PPE must be donned by all workers performing pre-cleaning activities. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.
   c. Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location.
2. Pre-Cleaning Fixed Objects:
   a. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area.

b. Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums and wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult, but contamination may be significant. Also, pay particular attention to wall, floor, and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with 2-layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must remain in the regulated area and that require special ventilation or enclosure requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.

3. Pre-Cleaning Surfaces in the Regulated Area:
   a. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area.

   b. Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos-containing materials during this pre-cleaning phase.

H. Pre-Abatement Activities:
1. Pre-Abatement Meeting: The VA Representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH/CIH that all materials and equipment required for the project are on the site, will arrange for a pre-abatement meeting between the Contractor, the CPIH/CIH, Competent Person, the VA Representatives, and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information or documentation to the VA's Representative regarding any submittals, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.
2. Pre-Abatement Inspections and Preparations:
   a. Before any work begins on the construction of the regulated area, the Contractor will:
      1) Conduct a space-by-space inspection with an authorized VA Representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.

2) The VA Representative, the Contractor, and the VPIH/CIH must be aware of AEQA 10-95 indicating the failure to identify asbestos in the areas listed as well as common issues when preparing specifications and contract documents. This is especially critical when demolition is planned, because AHERA surveys are non-destructive, and ACM may remain undetected. A NESHAP (destructive) ACM inspection should be conducted on all building structures that will be demolished. Ensure the following areas are inspected on the project: Lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside utility chases/walls; cementitious (transite™) piping/ductwork/sheets; behind radiators; lab fume hoods; cementitious (transite™) lab countertops; roofing materials; below window sills; water/sewer lines; electrical conduit coverings; crawl spaces(previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; and steam line trench coverings.

3) Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination.

4) Inspect existing firestopping in the regulated area. Correct as needed.

3. Pre-Abatement Construction and Operations:

a. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.

b. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's Representative when the work is completed in accordance with this specification. The VA's Representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP(s), especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation.

c. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's Representative.

d. Upon satisfactory inspection of the installation of and operation of systems the VA's Representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification.

3.2 REMOVAL OF PIPING ACM

A. Wetting Materials:

1. Use amended water for the wetting of ACM prior to removal. The Competent Person shall assure that the wetting of ACM meets the definition of "adequately wet" in the EPA NESHAP

regulation and OSHA's "wet methods" for the duration of the project. A removal encapsulant may be used instead of amended water with written approval of the VA's Representative.

2. Amended Water: Provide water to which a surfactant has been added to wet the ACM and reduce the potential for fiber release during disturbance of ACM. The mixture must be equal to or greater than the wetting provided by water amended by a surfactant consisting of one ounce of 50 percent polyoxyethylene ester and 50 percent polyoxyethylene ether mixed with 5 gallons (19L) of water.
3. Removal Encapsulant: Provide a penetrating encapsulant designed specifically for the removal of ACM. The material must, when used, result in adequate wetting of the ACM and retard fiber release during disturbance equal to or greater than the amended water described above in B.

B. Secondary Barrier and Walkways: Install as a drop cloth a 6-mil poly sheet at the beginning of each work shift where removal is to be done during that shift. Secure the drop cloth (6-mil poly sheet) with duct tape or approved equivalent to prevent it from moving or debris from getting behind it. Remove the drop cloth (6-mil poly sheet) at the end of the shift or as work in the area is completed. Keep residue on the drop cloth (6-mil poly sheet) wetted. When removing, fold inward to prevent spillage and place in a disposal bag.

C. Wet Removal of ACM: Using acceptable Glovebag procedures, adequately and thoroughly wet the ACM to be removed prior to removal with amended water or when authorized by VA, removal encapsulant to reduce/prevent fiber release to the air. Adequate time must be allowed for the amended water or removal encapsulant to saturate the ACM. Abatement personnel must not disturb dry ACM. Use a fine spray of amended water or removal encapsulant. Saturate the material sufficiently to wet to the substrate without causing excessive dripping. The material must be sprayed repeatedly/continuously during the removal process in order to maintain adequately wet conditions. Removal encapsulants must be applied in accordance with the manufacturer's written instructions. Perforate or carefully separate, using wet methods, an outer covering that is painted or jacketed in order to allow penetration and wetting of the material. Where necessary, carefully remove covering while wetting to minimize fiber release.

3.3 GLOVEBAG REMOVAL PROCEDURES

A. General: All applicable OSHA requirements and Glovebag manufacturer's recommendations shall be met during Glovebag removal operations. In cases where live steam lines are present, the lines must be shut down prior to any work being performed on the system. No abatement work shall be conducted on live, pressurized steam lines. The Contractor may choose to use a High Temperature Glovebag in which a temperature rating ranges from 300˚F to 700˚F on steam lines that have recently been shut down and remain at high temperature for some time. In the case where a Glovebag is not feasible, the Contractor will need to build a full negative pressure containment of sufficient size or work within a negative pressure mini-enclosure and follow all

regulations as it pertains to removal. The Contractor shall provide enough HEPA negative air machines to continuously maintain a negative pressure differential of -0.02 inch water column gauge (WCG) inside the regulated work area relative to adjacent non-work building areas. OSHA 29 CFR 1926.1101 (g)(5)(i)(A)(2) also requires at least four (4) air changes per hour. Contractor shall increase air changes per hour as necessary to maintain volatile organic compounds below the applicable OSHA PEL. Contractor shall protect pipe insulation from being disturbed on either side of the Glovebag removal operations with a “candy stripe” layer of 6-mil poly sheet and duct tape, if Glove bag removal activities cause the piping to dislodge ACM during performance of their work.

1. Mix the surfactant with water in the garden sprayer, following the manufacturer's directions.
2. Have each employee put on a HEPA filtered respirator approved for asbestos and check the fit using the positive/negative fit check.
3. Have each employee put on a disposable full-body suit. Remember, the hood goes over the respirator straps.
4. Check closely the integrity of the glove bag to be used. Check all seams, gloves, sleeves, and glove openings. OSHA requires the bottom of the bag to be seamless.
5. Check the pipe where the work will be performed. If it is damaged (broken lagging, hanging, etc.), wrap the entire length of the pipe in poly sheeting and "candy stripe" it with duct tape.
6. Attach Glovebag with required tools per manufacturer’s instructions.
7. Using the smoke tube and aspirator bulb, test 10 percent of Glovebags by placing the tube into the water porthole (two-inch opening to glove bag), and fill the bag with smoke and squeeze it. If leaks are found, they shall be taped closed using duct tape and the bag shall be retested with smoke.
8. Insert the wand from the water sprayer through the water porthole.
9. Insert the hose end from a HEPA vacuum into the upper portion of the glove bag.
10. Wet and remove the pipe insulation.
11. If the section of pipe is covered with an aluminum jacket, remove it first using the wire cutters to cut any bands and then use tin snips to remove the aluminum. It is important to fold the sharp edges in to prevent cutting the bag when placing it in the bottom.
12. When the work is complete, spray the upper portion of the bag and move all residue into the bottom of the bag with the other waste material. Be very thorough. Use adequate water.
13. Put all tools, after washing them off in the bag, in one of the sleeves of glove bag and turn it inside out, drawing it outside of the bag. Twist the sleeve tightly several times to seal it and tape it several tight turns with duct tape. Cut through the middle of the duct tape and remove the sleeve. Put the sleeve in the next glove bag or put it in a bucket of water to decontaminate the tools after cutting the sleeve open.

14. Turn on the HEPA vacuum and collapse the bag completely. Remove the vacuum nozzle, seal the hole with duct tape, twist the bag tightly several times in the middle, and tape it to keep the material in the bottom during removal of the glove bag from the pipe.
15. Slip a disposal bag over the glove bag (still attached to the pipe). Remove the tape securing the ends, and slit open the top of the glove bag and carefully fold it down into the disposal bag. Double bag and gooseneck waste materials.

B. Negative Pressure Glovebag Procedure:
1. In addition to the above requirements, the HEPA vacuum shall be run continuously during the Glovebag procedure until completion at which time the Glovebag will be collapsed by the HEPA vacuum prior to removal from the pipe/component.
2. The HEPA vacuum shall be attached and operated as needed to prevent collapse of the Glovebag during the removal process.

3.4 LOCKDOWN ENCAPSULATION

A. General: Lockdown encapsulation is an integral part of the ACM removal. At the conclusion of ACM removal and before removal of the primary barriers, all piping surfaces shall be encapsulated with a bridging encapsulant.

B. Sealing Exposed Edges: Seal edges of ACM exposed by removal work with two coats of encapsulant. Prior to sealing, permit the exposed edges to dry completely to permit penetration of the encapsulant.

3.5 DISPOSAL OF ACM WASTE MATERIALS

A. General: Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging must also be met. Transport will be in compliance with 49 CFR 171 - 180 regulations. Disposal shall be done at an approved landfill. Disposal of non-friable ACM shall be done in accordance with applicable regulations.

B. Procedures:
1. The VA must be notified at least 24 hours in advance of any waste removed from the containment
2. Asbestos waste shall be packaged and moved through the W/EDF into a covered transport container in accordance with procedures in this specification. Waste shall be double-bagged and wetted with amended water prior to disposal. Wetted waste can be very heavy. Bags shall not be overfilled. Bags shall be securely sealed to prevent accidental opening and/or leakage. The top shall be tightly twisted and goose necked prior to tightly sealing with at least three wraps of duct tape. Ensure that unauthorized persons do not have access to the waste material once it is outside the regulated area. All transport containers must be covered at all times when not in use. OSHA Danger signs must be displayed during loading and unloading.

Material shall not be transported in open vehicles. If drums are used for packaging, the drums shall be labeled properly and shall not be re-used.

3. Waste Load Out: Waste load out shall be done in accordance with the procedures in W/EDF Decontamination Procedures. Sealed waste bags shall be decontaminated on exterior surfaces by wet cleaning and HEPA vacuuming before being placed in the second waste bag and sealed, which then must also be wet wiped and HEPA vacuumed.
4. Asbestos waste with sharp edged components, i.e., nails, screws, lath, strapping, tin sheeting, jacketing, metal mesh, etc., which might tear poly bags shall be wrapped securely in burlap before packaging and, if needed, use a poly lined fiber drum as the second container, prior to disposal.

3.6 PROJECT DECONTAMINATION

A. General:
   1. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.
   2. If the asbestos abatement work is in an area which was contaminated prior to the start of abatement, the decontamination will be done by cleaning the primary poly barrier prior to its removal and cleanings of the surfaces of the regulated area after the primary barrier removal.
   3. If the asbestos abatement work is in an area which was uncontaminated prior to the start of abatement, the decontamination will be done by cleaning the primary poly barrier prior to its removal, thus preventing contamination of the building when the regulated area critical barriers are removed.
B. Regulated Area Clearance: Air testing and other requirements which must be met before release of the Contractor and re-occupancy of the regulated area space are specified in Final Testing Procedures.
C. Work Description: Decontamination includes the clearance air testing in the regulated area and the decontamination and removal of the enclosures/facilities installed prior to the abatement work including primary/critical barriers, PDF and W/EDF facilities, and negative pressure systems.
D. Pre-Decontamination Conditions:
   1. Before decontamination starts, all ACM waste from the regulated area shall be removed, all waste collected and removed, and the secondary barrier of poly removed and disposed of along with any gross debris generated by the work.
   2. At the start of decontamination, the following shall be in place.
      a. Critical barriers over all openings consisting of two layers of 6-mil poly which is the sole barrier between the regulated area and the rest of the building or outside.
      b. Decontamination facilities, if required for personnel and equipment in operating condition.
E. First Cleaning: Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and HEPA

vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications. The negative pressure system shall remain in operation during this time, if used. Additional cleaning may be needed as determined by the CPIH/VPIH/CIH.

F. Pre-Clearance Inspection and Testing: The CPIH/CIH and VPIH/CIH will perform a thorough and detailed visual inspection at the end of the cleaning to determine whether there is any visible residue in the regulated area. If the visual inspection is acceptable, the CPIH/CIH will perform pre-clearance sampling using aggressive clearance as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). If the sampling results show values below 0.01 f/cc, then the Contractor shall notify the VA's Representative of the results with a brief report from the CPIH/CIH documenting the inspection and sampling results and a statement verifying that the regulated area is ready for lockdown encapsulation. The VA reserves the right to utilize their own VPIH/CIH to perform a pre-clearance inspection and testing for verification.

G. Lockdown Encapsulation of Abated Surfaces: With the express written permission of the VA's Representative, perform lockdown encapsulation of all surfaces from which asbestos was abated in accordance with the procedures in this specification.

3.7 FINAL VISUAL INSPECTIONS AND AIR CLEARANCE TESTING

A. General: Notify the VA Representative 24 hours in advance for the performance of the final visual inspection and testing. The final visual inspection and testing will be performed by the VPIH/CIH after the final cleaning.

B. Final Visual Inspection: Final visual inspection will include the entire regulated area, the PDF, all poly sheeting, seals over HVAC openings, doorways, windows, and any other openings. If any debris, residue, dust or any other suspect material is detected, the final cleaning shall be repeated at no additional cost to the VA. Dust/material samples may be collected and analyzed at no additional cost to the VA at the discretion of the VPIH/CIH to confirm visual findings. When the regulated area is visually clean the final testing can be done.

C. Final Air Clearance Testing:

1. After an acceptable final visual inspection by the VPIH/CIH, the VPIH/CIH will perform the final clearance testing. Air samples will be collected and analyzed in accordance with procedures for AHERA in this specification. If work is less than 260 lf/160 sf/35 cf, 5 PCM samples shall be collected for clearance and a minimum of two field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA presented in this specification. If the release criteria are not met, the Contractor shall repeat the final cleaning

and continue decontamination procedures until clearance is achieved. All additional inspection and testing costs will be borne by the Contractor.

2. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

D. Final Air Clearance Procedures:

1. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured by the AHERA PCM protocol, and < 70 AHERA asbestos structures per square millimeter (s/mm2) by AHERA TEM. No averaging of results will be used for this project. All five (5) TEM samples inside the regulated area shall be at or below 70 asbestos s/mm2 to satisfy the project final clearance criteria.
2. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures:
   a. Fibers Counted: “Fibers” referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.
   b. Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques except where soil is not encapsulated or enclosed. Samples will be collected on 0.8µ MCE filters for PCM analysis and 0.45µ MCE for TEM. A minimum of 3850 Liters of air using calibrated sampling pumps shall be collected for PCM samples and a minimum of 1200 Liters of air using calibrated sampling pumps shall be collected for TEM clearance samples. Before pumps are started, initiate aggressive air mixing sampling as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). Air samples will be collected in areas subject to normal air circulation away from corners, obstructed locations, and locations near windows, doors, or vents. After air sampling pumps have been shut off, circulating fans shall be shut off. The negative pressure system shall continue to operate.

E. Clearance Sampling Using PCM:

1. The VPIH/CIH will perform clearance samples as indicated by the specification.
2. The NIOSH 7400 PCM method will be used for clearance sampling with a minimum collection volume of 1,200 Liters of air. A minimum of 5 PCM clearance samples shall be collected. All samples must be equal to or less than 0.01 f/cc to clear the regulated area.

F. Clearance Sampling Using TEM:

1. Clearance requires 13 samples be collected; 5 inside the regulated area; 5 outside the regulated area; and 3 field blanks.

2. The TEM method will be used for clearance sampling with a minimum collection volume of 1,200 Liters of air. A minimum of 13 clearance samples shall be collected. All samples must be equal to or less than 70 AHERA structures per square millimeter (s/mm2) AHERA TEM, no averaging of results for this specific project.

G. Laboratory Testing of PCM Samples: The services of an AIHA accredited laboratory will be employed by the VA to perform analysis for the PCM air samples. The accredited laboratory shall be successfully participating in the AIHA Proficiency Analytical Testing (PAT) program. Samples will be sent daily by the VPIH/CIH so that verbal/faxed reports can be received within 24-36 hours. A complete record, certified by the laboratory, of all air monitoring tests and results will be furnished to the VA's Representative and the Contractor.

H. Laboratory Testing of TEM Samples: Samples shall be sent by the VPIH/CIH to a NIST NVLAP accredited laboratory for analysis by TEM. The laboratory shall be successfully participating in the NIST NVLAP Airborne Asbestos Analysis (TEM) program. Verbal/faxed results from the laboratory shall be available within 24-36 hours after receipt of the samples. A complete record, certified by the laboratory, of all TEM results shall be furnished to the VA's Representative and the Contractor.

3.8 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

A. Completion of Abatement Work: After thorough decontamination, seal negative air machines with 2-layers of 6-mil poly and duct tape to form a tight seal at the intake/outlet ends before removal from the regulated area. Complete asbestos abatement work upon meeting the regulated area visual and air clearance criteria and fulfilling the following:

1. Remove all equipment, materials, and debris from the project area.
2. Package and dispose of all asbestos waste as required. Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging must also be met. Transport will be in compliance with 49 CFR 171 – 180 regulations.
3. Repair or replace all interior finishes damaged during the abatement work.
4. The VA will be notified of any waste removed from the containment prior to 24 hours.
5. Fulfill other project closeout requirements as specified elsewhere in this specification.

B. Certificate of Completion by Contractor: The CPIH/CIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area.

C. Work Shifts: All work shall generally be done during administrative hours (8:00 AM to 4:30 PM) Monday - Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative.

D. Re-Insulation: If required as part of the contract, replace all asbestos containing insulation with suitable non-asbestos material. Provide SDS for all replacement materials. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

ATTACHMENT #1
CERTIFICATE OF COMPLETION

DATE: _____ VA Project #:_____

PROJECT NAME:_____ Abatement Contractor:_____

VAMC/ADDRESS:_____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):
   which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer’s recommendations.

CPIH/CIH Signature/Date:_____

CPIH/CIH Print Name:_____

Abatement Contractor Signature/Date:_____

Abatement Contractor Print Name:_____

ATTACHMENT #2
CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME:_____DATE:_____

PROJECT ADDRESS:_____

ABATEMENT CONTRACTOR'S NAME:_____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate of worker’s acknowledgement you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32-hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

Physical Characteristics and Background Information on Asbestos
Potential Health Effects Related to Exposure to Asbestos
Employee Personal Protective Equipment
Establishment of a Respiratory Protection Program
State of the Art Work Practices
Personal Hygiene
Additional Safety Hazards
Medical Monitoring
Air Monitoring
Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature:_____
Printed Name:_____
Social Security Number (last 4 digits):_____
Witness:_____

ATTACHMENT #3
AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER:_____

VA MEDICAL FACILITY:_____

ABATEMENT CONTRACTOR'S NAME AND ADDRESS:_____

1. I verify that the following individual
   Name:_____ Social Security Number:_____who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.
   Address:_____
2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH:_____ Date:_____

Printed Name of CPIH/CIH:_____

Signature of Contractor:_____ Date:_____

Printed Name of Contractor:_____

ATTACHMENT #4
ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location:_____

VA Project #:_____

VA Project Description:_____

This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature_____Date_____

- - - END - - -

SECTION 02 82 13.19
ASBESTOS FLOOR TITLE AND MASTIC ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY OF THE WORK

A. Contract Documents and Related Requirements: Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Asbestos Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred due to such action are also the responsibility of the Asbestos Abatement Contractor.

B. Extent of Work:

1. Below is a brief description of the estimated quantities of asbestos flooring and mastic materials to be abated. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy himself as to the actual quantities to be abated. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.

2. Removal, clean-up, and disposal of the following asbestos-containing materials (ACM) and asbestos/waste contaminated elements in an appropriate:

Material Description	Material Location(s)	Estimated Quantity
9”x9” Brown with White Streak Floor Tile with Non-Asbestos-Containing Black Mastic	1st Floor: Southeast Corner of Main Area and South Wing (Under Carpet), North Storage Closet (Room 103B)	1,200 Square Feet (SF)
12”x12” White Floor Tile (Bottom Layer) with Non-Asbestos-Containing Black Mastic Beneath Non-Asbestos-Containing 12”x12” White with Gray Steak Floor Tile (Top Layer) and Yellow Mastic	1st Floor Central Restroom	50 SF
9”x9” Brown Floor Tile with Non-Asbestos-Containing Black Mastic and Brown Floor Leveler	2nd Floor: South Wing	900 SF

Material Description	Material Location(s)	Estimated Quantity
Black Mastic on Concrete and/or Wood Floors	Rooms: 102 and 103	1,400 SF

3. The General Contractor, not the asbestos abatement contractor, shall retain the services of an independent third-party consultant appropriately experienced and trained/licensed to conduct the onsite abatement VPIH/CIH monitoring services for the duration of the abatement as outlined in this specification. The abatement contractor shall be responsible for their own CPIH/CIH services outline in this specification.

C. Related Work:
   1. Section 07 84 00, FIRESTOPPING
   2. Section 02 41 00, DEMOLITION
   3. Section 02 82 11, Traditional Asbestos Abatement
   4. Section 02 82 13.13, Glovebag Asbestos Abatement
   5. Section 02 82 13.31, Asbestos Transite-Type Abatement
   6. Section 02 83 33.13, Lead-Based Paint Removal and Disposal
   7. Division 09, FINISHES
   8. Division 22, PLUMBING

D. Tasks:
   1. The work tasks are summarized briefly as follows:
      a. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, regulated area preparations, emergency procedures arrangements, and Asbestos Hazard Abatement Plans for asbestos work.
      b. Abatement activities including removal , encapsulation, enclosure, clean-up and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.
      c. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.
      d. NOTE: The VPIH/CIH services shall be performed by an independent consultant hired by the GENERAL CONTRACTOR (NOT THE ABATEMENT CONTRACTOR) as further described in specification.

E. Abatement Contractors Use of Premises:
   1. The Contractor and Contractor's personnel shall cooperate fully with the VA representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing

plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.

2. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedures. VA Design Construction Procedure drawings of partially occupied buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building; and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA Representative through the pre-abatement plan of action.

1.2 VARIATIONS IN QUANTITY

A. The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 10 percent) in quantities of ACM within the regulated area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered ACM and those prices shall be used for additional work required under the contractor.

1.3 STOP ASBESTOS REMOVAL

A. If the Contracting Officer; their field representative; the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal **Stop Asbestos Removal Order**, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed ACM. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as it is practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor's competent person to the VA Contracting Office or field representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities if:

1. Airborne PCM analysis results equal to or greater than 0.01 f/cc above background levels inside the building but outside the regulated area;

2. breach or break in regulated area containment barrier(s);
3. less than –0.02-inch WCG pressure in the regulated area;
4. serious injury/death at the site;
5. fire/safety emergency at the site;
6. respiratory protection system failure;
7. power failure or loss or inadequate use of wetting agent;
8. any visible emissions observed outside the regulated area; or
9. failure to follow project specification requirements.

1.4 DEFINITIONS

A. General: Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

B. Glossary:

Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, encapsulation, enclosure, demolition, and renovation activities related to asbestos containing materials (ACM).

Adequately wet - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.

Aerosol - Solid or liquid particulate suspended in air.

Aggressive method - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.

Aggressive air sampling - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.

AHERA - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.

Aircell - Pipe or duct insulation made of corrugated cardboard which contains asbestos.

Air monitoring - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 3, Fifth Edition is used to determine the fiber levels in air. For personal samples, area air samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis, the NIOSH Method 7402 (Issue 2, Fourth Edition) can be used when it is necessary to confirm fibers counted by PCM as being asbestos. The AHERA TEM analysis may be used for background, area samples and clearance samples when required by this specification, or at the discretion of the VPIH/CIH as appropriate.

Air sample filter - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester (MCE) membrane for PCM (Phase Contrast Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.8-micron pore size) and MCE for TEM (Transmission Electron Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.45 micron pore size).

Amended water - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.

Asbestos - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.

Asbestos Hazard Abatement Plan (AHAP) - Asbestos work procedures required to be submitted by the contractor before work begins.

Asbestos-containing material (ACM) - Any material containing more than one percent of asbestos.

Asbestos contaminated elements (ACE) - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.

Asbestos-contaminated soil (ACS) – Soil found in the work area or in adjacent areas such as crawlspaces or pipe tunnels which is contaminated with asbestos-containing material debris and cannot be easily separated from the material.

Asbestos-containing waste (ACW) material - Asbestos-containing material or asbestos contaminated objects requiring disposal.

Asbestos Project Monitor – Some states require that any person conducting asbestos abatement air sampling, clearance inspections and clearance air sampling be licensed as an asbestos project monitor.

Asbestos waste decontamination facility - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of asbestos waste. Used as the exit for waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel.

Authorized person - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.

Authorized visitor - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA).

Barrier - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.

Containment Barrier - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.

Critical Barrier - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of 2-layers of 6-mil independently installed plastic sheeting (Polyethylene)

secured in place at openings such as doors, windows, penetrations or any other opening into the regulated area.

Primary Barrier – Plastic barriers placed over critical barriers and exposed directly to abatement work or to secondary barrier.

Secondary Barrier - Any additional plastic barriers used to isolate and provide protection from debris during abatement work.

Breathing zone - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.

Bridging encapsulant - An encapsulant that forms a layer on the surface of the ACM.

Building/facility owner - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.

Bulk testing - The collection and analysis of suspect asbestos containing materials.

Certified Industrial Hygienist (CIH) - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.

Class I asbestos work - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).

Class II asbestos work - Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.

Clean room/Changing room - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.

Clearance sample - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's Professional Industrial Hygiene consultant/Certified Industrial Hygienist (VPIH/CIH).

Closely resemble - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

Competent person - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.

Contractor's Professional Industrial Hygienist (CPIH/CIH) - The asbestos abatement contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of a PIH and may report to a certified industrial hygienist (CIH).

Count - Refers to the fiber count or the average number of fibers greater than five microns in length with a length-to-width (aspect) ratio of at least 3 to 1, per cubic centimeter of air.

Crawlspace – An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain asbestos materials and/or asbestos contaminated soil.

Decontamination area/unit - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

Demolition - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

Disposal bag - Typically 6-mil thick sift-proof, dustproof, leak-tight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.

Disturbance – Asbestos Operations and Maintenance Activities (OSHA Class III) that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or disposal bag, which shall not exceed 60 inches in length or width.

Drum - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.

Employee exposure - The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.

Encapsulant - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.

Encapsulation - Treating ACM with an encapsulant.

Enclosure - The construction of an airtight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.

Equipment room - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

Fiber - A particulate form of asbestos, 5 microns or longer, with a length to width (aspect) ratio of at least 3 to 1.

Fibers per cubic centimeter (f/cc) - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.

Filter - Media used in respirators, vacuums, or other machines to remove particulate from air.

Firestopping - Material used to close the open parts of a structure in order to prevent a fire from spreading.

Friable asbestos containing material - Any material containing more than one (1) percent asbestos as determined using the method specified in 40 CFR 763, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

Glovebag - Not more than a 60 x 60-inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.

High efficiency particulate air (HEPA) filter – An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

HEPA vacuum - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.

Homogeneous area - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.

HVAC - Heating, Ventilation and Air Conditioning

Industrial hygienist (IH) - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).

Industrial hygienist technician (IH Technician) - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned. Some states require that an industrial hygienist technician conducting asbestos abatement air sampling, clearance inspection and clearance air sampling be licensed as an asbestos project monitor.

Intact - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Lockdown - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.

National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA's rule to control emissions of asbestos to the environment (40 CFR part 61, Subpart M).

Negative initial exposure assessment - A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL or Excursion Limit (EL).

Negative pressure - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02-inch water column gauge inside the negative pressure enclosure.

Negative pressure respirator - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.

Non-friable ACM - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Organic vapor cartridge - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.

Outside air - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.

Owner/operator - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

Penetrating encapsulant - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.

Permissible exposure limit (PEL) - The level of exposure OSHA allows for as an eight (8) hour time-weighted average (TWA). For asbestos fibers, the eight (8) hour time-weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit (EL) is 1.0 fibers per cubic centimeter (1 f/cc).

Personal protective equipment (PPE) – equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, fall protection, and respirators.

Personal sampling/monitoring - Representative air samples obtained in the breathing zone for one or more workers within the regulated area using a filter cassette and a calibrated air sampling pump to determine asbestos exposure.

Pipe tunnel – An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, debris or asbestos-contaminated soil.

Polarized light microscopy (PLM) - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type of asbestos present in a bulk sample.

Polyethylene sheeting - Strong plastic barrier material 4 to 6-mils thick, semi-transparent, flame retardant per NFPA 241.

Positive/negative fit check - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator, respectively.

Presumed ACM (PACM) - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge or should have known through

the exercise of due diligence that other materials are ACM, they too must be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (k)(5).

Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH/CIH) or Contractor's PIH (CPIH/CIH).

Project designer - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Subpart E, Appendix C, Part I; (B)(5).

Assigned protection factor - A value assigned by OSHA/NIOSH to indicate the expected protection provided by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.

Qualitative fit test (QLFT) - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.

Quantitative fit test (QNFT) - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.

Regulated area - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.

Removal - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.

Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.

Repair - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.

Shower room - The portion of the PDF where personnel shower before leaving the regulated area.

Supplied air respirator (SAR) - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-2018.

Surfacing ACM - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, decorative, fireproofing and other purposes.

Surfactant - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.

Thermal system ACM - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.

Transmission electron microscopy (TEM) - A microscopy method that can identify and count asbestos fibers.

VA Professional Industrial Hygienist (VPIH/CIH) – The Department of Veterans Affairs Professional Industrial Hygienist must meet the qualifications of a PIH and may report to a Certified Industrial Hygienist (CIH).

VA Representative - The VA official responsible for on-going project work.

VA Total – means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.

Visible emissions - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM/ACS or ACM waste material.

Waste/Equipment decontamination facility (W/EDF) – The area in which equipment is decontaminated before removal from the regulated area.

Waste generator - Any owner or operator whose act or process produces asbestos-containing waste material.

Waste shipment record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

Wet cleaning - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

C. Referenced Standards Organizations: See Section 01 42 19 REFERENCED STANDARDS.

1.5 APPLICABLE CODES AND REGULATIONS

A. General Applicability of Codes, Regulations, and Standards:

1. All work under this contract shall be done in strict accordance with all applicable Federal, State, and Local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.

2. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.
3. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system and/or the Contractor's on-site Field Office. These standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 may be made available electronically.

B. Contractor Responsibility: The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE), including respiratory protection and respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Abatement Contractor will incur all costs of the CPIH/CIH, including all sampling/analytical costs to assure compliance with OSHA/EPA/State/Local requirements related to failure to comply with the regulations applicable to the work.

C. Federal Requirements:
1. Federal requirements which govern asbestos abatement include, but are not limited to, the following regulations:
   a. Occupational Safety and Health Administration **(OSHA)**
      1) Title 29 CFR 1926.1101 - Construction Standard for Asbestos
      2) Title 29 CFR 1926 Subpart E - Personal Protective Equipment and Life Saving Equipment
      3) Title 29 CFR 1910.134 - Respiratory Protection
      4) Title 29 CFR 1926 - Construction Industry Standards
      5) Title 29 CFR 1926.33 - Access to Employee Exposure and Medical Records
      6) Title 29 CFR 1926.59 same as 1910.1200 - Hazard Communication
      7) Title 29 CFR 1926 Subpart C – General Safety and Health Provisions and Subpart D – Occupational Health and Environmental Controls
   b. Environmental Protection Agency **(EPA)**:
      1) 40 CFR 61 Subpart M - National Emission Standard for Hazardous Air Pollutants - Asbestos.

2)40 CFR 763 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos Hazard Abatement Reauthorization Act (ASHARA)

c. Department of Transportation **(DOT)**

1)Title 49 CFR 171 - 180 – Transportation

D. State Requirements:

1. State requirements that apply to the asbestos abatement work, disposal, clearance, etc., include, but are not limited to, the following:

The Ohio Administrative Code (OAC) 3745-20 contains regulations for controlling asbestos emissions from demolition and renovation projects. Ohio's regulations are consistent with U.S. EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) regarding asbestos. The regulations require that contractors do several things, such as provide a notification, conduct thorough inspections to determine the presence of asbestos, follow specific work practices, and ensure proper disposal of asbestos-containing material.

The Ohio EPA asbestos program licenses and certifies companies and persons directly involved with the asbestos abatement industry. OAC 3745-22 contains regulations pertaining to contractors performing asbestos removal projects, project supervisors, project designers, workers removing asbestos, persons inspecting buildings for asbestos-containing materials and developing plans to manage asbestos found in a facility, persons conducting air sampling for asbestos and the companies that provide required asbestos training. The asbestos program ensures the safety and quality of asbestos services by requiring persons to take approved training that is specific to the asbestos related activities in which they will be involved and by inspecting/auditing the activities of the program participants.

E. Local Requirements:

1. If local requirements are more stringent than federal or state standards, the local standards are to be followed.
2. Montgomery County, Ohio Regulation 150.

F. Standards:

1. Standards which govern asbestos abatement activities include, but are not limited to, the following:
   a. American National Standards Institute (ANSI)/ASSP Z9.2-2018 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI/ASSE Z88.2-2015 - Practices for Respiratory Protection.
   b. Underwriters Laboratories (UL) 586-2009 - UL Standard for Safety of HEPA Filter Units, 9th Edition; ANSI Approval 2017-12-19.
2. Standards which govern encapsulation work include, but are not limited to the following:
   a. American Society for Testing and Materials International (ASTM)

3. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
   a. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
   b. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
   c. NFPA 101 - Life Safety Code

G. EPA Guidance Documents:
1. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference.
2. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024
3. Asbestos Waste Management Guidance EPA 530-SW-85-007
4. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001
5. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990

H. Notices:
1. State and Local agencies: Send written notification as required by State and Local regulations prior to beginning any work on ACM as follows:
   Submit prior abatement notification to the Ohio EPA at least 10-business days prior to start of work. Ohio EPA notifications can be completed online at www.ebiz.epa.ohio.gov.

2. Copies of notifications shall be submitted to the VA for the facility's records in the same time frame notification are given to EPA, State, and Local regulations prior to beginning any work on ACM as follows.

I. Permits/Licenses: The contractor shall apply for and have all required permits and licenses to perform asbestos abatement work as required by Federal, State, and Local regulations.

J. Posting and Filing of Regulations: Maintain two (2) copies of applicable Federal, State, and Local regulations. Post one copy of each at the regulated area where workers will have daily access to the regulations and keep another hard copy or electronic copy in the Contractor's office.

K. VA Responsibilities prior to commencement of work:
1. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment, and personal possessions to avoid unauthorized access into the regulated area. **Note: Notification of adjacent personnel is required by OSHA in 29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area**.
2. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized, calibration data and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air

sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

L. Site Security:

1. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and Representatives, State and Local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and shall be posted in the clean room of the decontamination unit.

2. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent person shall immediately notify the VA Representative.

3. A logbook shall be maintained in the clean room of the decontamination unit. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.

4. Access to the regulated area shall be through a critical barrier doorway. All other access (doors, windows, hallways, etc.) shall be sealed or locked to prevent entry to or exit from the regulated area. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall <u>not</u> be locked from the inside; however, they shall be sealed with poly sheeting and taped until needed.

5. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24-hour security system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.

6. The regulated area shall be locked during non-working hours and secured by VA security guards.

M. Emergency Action Plan and Arrangements:

1. An Emergency Action Plan shall be developed prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1926, Subpart C, Standard 1926.35 Employee Emergency Action Plans.
2. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
3. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.

4. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.
5. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
   a. For non-life-threatening situations - employees injured or otherwise incapacitated shall be decontaminated following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
   b. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, medical personnel shall remove them from the regulated area if back or neck injury is present, and secure proper medical treatment.
6. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
7. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.
8. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the Asbestos Hazard Abatement Plans during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

N. Pre-Construction Meeting:
1. Prior to commencing the work, the Contractor shall meet with the VA Certified Industrial Hygienist (VPIH/CIH) to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:
   a. Proof of Contractor licensing.
   b. Proof the Competent Person(s) is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person(s) shall also be presented.
   c. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
   d. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.

e. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.1101 (m).

f. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.

g. A copy of the Contractor's Asbestos Hazard Abatement Plan. In these procedures, the following information must be detailed, specific for this project.

1)Regulated area preparation procedures;

2)Notification requirements procedure of Contractor as required in 29 CFR 1926.1101 (d) Multi-Employer Worksites;

3)Decontamination area set-up/layout and decontamination procedures for employees;

4)Abatement methods/procedures and equipment to be used;

5)Personal protective equipment to be used.

h. At this meeting the Contractor shall provide all submittals as required.

i. Procedures for handling, packaging and disposal of asbestos waste.

j. Emergency Action Plan and Contingency Plan Procedures.

1.6 PROJECT COORDINATION

A. The following are the minimum administrative and supervisory personnel necessary for coordination of the work.

1. Personnel:

a. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.

b. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; last four digits of social security number; qualifications; accreditation card with color picture, if required by state; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.

c. Minimum qualifications for Contractor and assigned personnel are:

1)The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of Federal (and State or Local as applicable) EPA and OSHA asbestos regulations in the past three (3) years; has adequate

liability/occurrence insurance for asbestos work as required by the state; is licensed in applicable state; has adequate and qualified personnel available to complete the work; has comprehensive Abatement Hazard Abatement Plans for asbestos work; has adequate materials, equipment and supplies to perform the work.

2)The Competent Person has three (3) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.

3)The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have three (3) years of monitoring experience and supervision of asbestos abatement projects; has participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.

4)The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the Asbestos Hazard Abatement Plans of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; and has certificate of training/current refresher and State accreditation/license.

d. All personnel shall be in compliance with OSHA construction safety training as applicable and submit certification.

1.7 RESPIRATORY PROTECTION

A. General - Respiratory Protection Program: The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.134. ANSI Standard Z88.2-2015 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c) - Respiratory Protection Program.

B. Respiratory Protection Program Coordinator: The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years of experience coordinating RPP of similar

size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

C. Selection and Use of Respirators: The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit or in the onsite Contractor’s office, for reference by employees or authorized visitors.

D. Minimum Respiratory Protection: Shall be a ½-mask negative pressure air purifying respirator equipped with Combination P100 filters and Organic Vapor Cartridge, provided personal air samples in the workplace remain at or below 0.1 f/cc, and the applicable PEL for solvents, both determined as an 8-hour TWA. Full face powered air purifying respirator equipped with P100 filters and Organic Vapor Cartridge shall be required until Contractor demonstrates that personal air samples are at or below 0.1 f/cc, and the applicable PEL for solvents, both determined as an 8-hour TWA. A higher level of respiratory protection shall be required, if fiber levels exceed 1 f/cc as an 8-hour TWA, inside the regulated work area. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h) and 29 CFR 1910.134 (d)(3)(i)(A) Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

E. Medical Written Opinion: No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination, they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

F. Respirator Fit Test: All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Quantitative fit tests shall be done for PAPRs which have been put into a motor/blower failure mode.

G. Respirator Fit Check: The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from entering the regulated area until resolution of the problem.

H. Maintenance and Care of Respirators: The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) Maintenance and Care of Respirators.

I. Supplied Air Systems: If a supplied air system is used, the system shall meet all requirements of 29 CFR 1910.134 and the ANSI/Compressed Gas Association (CGA) Commodity Specification for Air current requirements for Type 1 - Grade D breathing air. Low pressure systems are not allowed to be used on asbestos abatement projects. Supplied Air respirator use shall be in

accordance with EPA/NIOSH publication EPA-560-OPTS-86-001 "A Guide to Respiratory Protection for the Asbestos Abatement Industry". The competent person on site will be responsible for the supplied air system to ensure the safety of the worker.

1.8 WORKER PROTECTION

A. Training of Abatement Personnel: Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Initial training certificates and current refresher and accreditation proof must be submitted for each person working at the site.

B. Medical Examinations: Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion that the person has been evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

C. Personal Protective Equipment: Provide whole body clothing, head coverings, foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

D. Regulated Area Entry Procedure: The Competent Person shall ensure that each time workers enter the regulated area they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

E. Decontamination Procedure: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.

1. When exiting the regulated area, remove all disposable PPE and dispose of in a disposable bag provided in the regulated area.
2. Carefully decontaminate and clean the respirator. Put in a clean container/bag.

F. Regulated Area Requirements: The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for Class II regulated areas at 29 CFR 1926.1101 (e) are met applicable to Class II work and this specification. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

A. Description: Provide each regulated area with separate personnel decontamination facilities (PDF) and waste/equipment decontamination facilities (W/EDF). Ensure that the PDF are the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the W/EDF.

B. General Requirements: All personnel entering or exiting a regulated area must go through the PDF and shall follow the requirements at 29 CFR 1926.1101 (j)(1) and these specifications. All waste, equipment and contaminated materials must exit the regulated area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF must be constructed of a minimum of 3-layers of 6-mil opaque fire-retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 3-layers of 6-mil poly shall also be used to cover the floor under the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

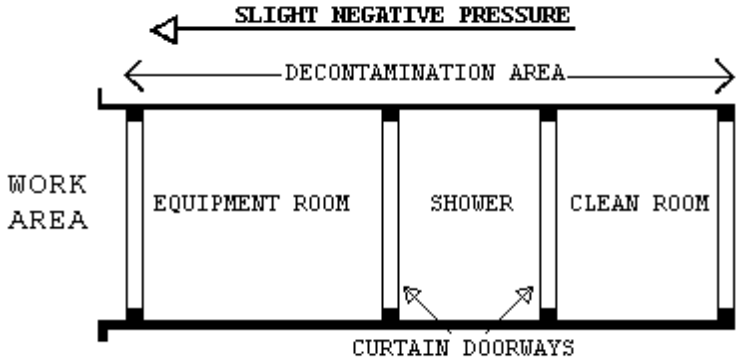
C. Temporary Facilities to the PDF and W/EDF: The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention must be provided at the point of connection to the VA system. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141 (d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel equipped with GFCI protection for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50-foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70°F throughout the PDF and W/EDF.

D. Personnel Decontamination Facility (PDF):

1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3-layers of 6-mil opaque fire-retardant poly to provide an airtight room. Provide a minimum of 2 - 900 mm (3 foot) wide 6-mil poly opaque fire-retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry and sanitary condition. Shower overflow shall not be allowed into the clean room. Provide 1 storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room

does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Male/Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male/female can enter or exit the PDF during his/her stay in the PDF.

2. Shower Room: The Competent Person shall assure that the shower room is a completely watertight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using airtight walls made from at least 3-layers of 6-mil opaque fire-retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Wastewater will be pumped to a drain after being filtered through a minimum of a 100-micron sock in the shower drain; a 20-micron filter; and a final 5 micron filter. Filters will be changed a minimum of daily or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste.
3. Equipment Room: The Competent Person shall provide an equipment room which shall be an airtight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The equipment room shall be separated from the regulated area by a minimum 3-foot-wide door made with 2-layers of 6-mil opaque fire-retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by airtight walls and ceiling constructed of a minimum of 3-layers of 6-mil opaque fire-retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6-mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area.
4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of 2 layers of 6-mil opaque fire-retardant poly.

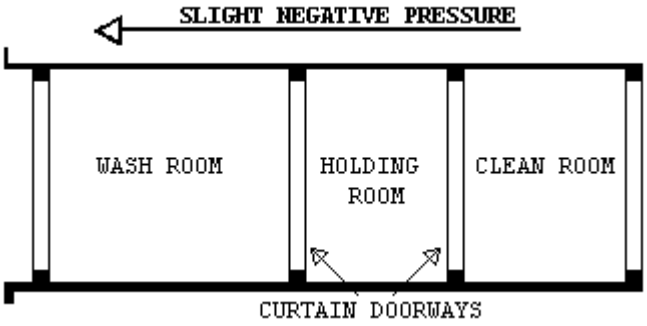


E. Waste/Equipment Decontamination Facility (W/EDF):

1. The Competent Person shall provide an W/EDF consisting of a wash room, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:
   a. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Washroom as an equipment bag and container cleaning station.
   b. Washroom: Provide a wash room for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the washroom using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and 3-layers of 6-mil fire retardant poly. Locate the washroom so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the washroom shall be constructed of 2-layers of 6-mil fire retardant poly.
   c. Holding Room: Provide a holding room as a drop location for bagged materials passed from the washroom. Construct the holding room using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and 3-layers of 6-mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the washroom to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of 2 layers of 6-mil fire retardant poly.
   d. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 inches x 4 inches wood framing or approved equivalent and 2-layers of 6-mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of 2-layers of 6-mil fire retardant poly. When a

negative pressure differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.

e. The W/EDF shall be as follows: Washroom leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



F. Waste/Equipment Decontamination Procedures: At the washdown station, in the regulated area, thoroughly wet clean contaminated equipment and/or sealed polyethylene bags and pass into Wash Room after visual inspection. When passing anything into the Wash Room, close all doorways of the W/EDF, other than the doorway between the washdown station and the Wash Room. Keep all outside personnel clear of the W/EDF. Once inside the Wash Room, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. At no time shall personnel from the clean side be allowed to enter the Wash Room.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. General Requirements (All Abatement Project): Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's Representative.

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.

3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mils. For floors and all other uses, sheeting of at least 6-mil shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
6. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape, poly tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or other approved equivalent procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
7. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6-mil fire retardant poly.
8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and wastewater filtration system shall be provided by the Contractor.
9. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
10. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
11. Disposal bags – 2 layers of 6-mil poly for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
12. The VA shall be provided an advance copy of the Safety Data Sheets (SDS) as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-project submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
13. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.

14. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

B. Negative Pressure Filtration System:

1. The Contractor shall provide enough HEPA negative air machines to continuously maintain a negative pressure differential of -0.02 inches water column gauge (WCG) inside the regulated work area relative to adjacent non-work building areas. OSHA 29 CFR 1926.1101 (g)(5)(i)(A)(2) also requires at least four (4) air changes per hour. Contractor shall increase air changes per hour as necessary to maintain volatile organic compounds below the applicable OSHA PEL. The Competent Person shall determine the number of units needed for the regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to continuously maintain a negative pressure differential of -0.02 inches WCG. Provide a standby unit in the event of machine failure and/or emergency in an adjacent area. HEPA equipped negative air machines shall be discharged outside of the building a minimum of 3 feet from building make-up air, doors, open windows, patients, visitors and staff.

2. NIOSH has done extensive studies and has determined that negative air machines typically operate at ~50 percent efficiency. The contractor shall consider this in their determination of number of units needed to continuously maintain a pressure differential of -0.02 inches WCG. The contractor shall use 8 air changes per hour or double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2 inches pressure drop across the filters.

C. Design and Layout:

1. Before start of work submit the design and layout of the regulated area and the negative air machines. The submittal shall indicate the number of, location of and size of negative air machines. The point(s) of exhaust, air flow within the regulated area, anticipated negative pressure differential, and supporting calculations for sizing shall be provided. In addition, submit the following:

a. Method of supplying power to the units and designation/location of the panels.
b. Description of testing method(s) for correct air volume and pressure differential.
c. If auxiliary power supply is to be provided for the negative air machines, provide a schematic diagram of the power supply and manufacturer's data on the generator and switch.

D. Negative Air Machines (HEPA Units)

1. Negative Air Machine Cabinet: The cabinet shall be constructed of steel or other durable material capable of withstanding potential damage from rough handling and transportation. The width of the cabinet shall be less than 30 inches in order to fit in standard doorways. The cabinet

must be factory sealed to prevent asbestos fibers from being released during use, transport, or maintenance. Any access to and replacement of filters shall be from the inlet end. The unit must be on casters or wheels.

2. Negative Air Machine Fan: The rating capacity of the fan must indicate the CFM under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan must be a centrifugal type fan.

3. Negative Air Machine Final Filter: The final filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an air tight seal. Each HEPA filter shall be certified by the manufacturer to have an efficiency of not less than 99.97 percent. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter must bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.

4. Negative Air Machine Pre-filters: The pre-filters, which protect the final HEPA filter by removing larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. A first stage pre-filter shall be a low efficiency type for particles 10 micron or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5 micron or larger. Pre-filters shall be installed either on or in the intake opening of the NAM and the second stage filter must be held in place with a special housing or clamps.

5. Negative Air Machine Instrumentation: Each unit must be equipped with a gauge to measure the pressure drop across the filters and to indicate when filters have become loaded and need to be changed. A table indicating the cfm for various pressure readings on the gauge shall be affixed near the gauge for reference or the reading shall indicate at what point the filters shall be changed, noting cfm delivery. The unit must have an elapsed time meter to show total hours of operation.

6. Negative Air Machine Safety and Warning Devices: An electrical/ mechanical lockout must be provided to prevent the fan from being operated without a HEPA filter. Units must be equipped with an automatic shutdown device to stop the fan in the event of a rupture in the HEPA filter or blockage in the discharge of the fan. Warning lights are required to indicate normal operation; too high a pressure drop across filters; or too low of a pressure drop across filters.

7. Negative Air Machine Electrical: All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriters Laboratories (UL). Each unit must be provided with overload protection and the motor, fan, fan housing, and cabinet must be grounded.

8. It is essential that replacement HEPA filters be tested using an “in-line” testing method, to ensure the seal around the periphery was not damaged during replacement. Damage to the outer HEPA filter seal could allow contaminated air to bypass the HEPA filter and be discharged to an inappropriate location. Contractor will provide written documentation of test results for negative air machine units with HEPA filters.

9. Pressure Differential: The fully operational negative air system within the regulated area shall continuously maintain a pressure differential ≥ -0.02 inches WCG inside the regulated work area. Before any disturbance of any asbestos material, this shall be demonstrated to the VA by use of a pressure differential meter/manometer as required by OSHA 29 CFR 1926.1101(g)(5)(i). The Competent Person shall be responsible for providing, maintaining, and documenting the negative pressure and air changes as required by OSHA and this specification.

2.2 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA

A. General:

1. Using critical barriers, seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area must be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated as a result of the work, Contractor shall immediately stop work and clean up the contamination at no additional cost to the VA. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Specification Section 07 84 00; FIRESTOPPING and Section 2.2.6.

2. Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects remaining in the regulated area shall be completely covered with 2-layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area

B. Controlling Access to the Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF). All other means of access shall be eliminated, and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to, or within view of an occupied area, provide a visual barrier of 6-mil opaque fire-retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.

C. Critical Barriers: Completely separate any operations in the regulated area from adjacent areas using 2-layers of 6-mil fire retardant poly and duct tape. Individually seal with 2-layers of 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.

D. Secondary Barriers: A loose layer of 6-mil poly shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced as needed during the work and at a minimum once per work day.

E. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. Decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.

F. Firestopping:

1. Through penetrations caused by cables, cable trays, pipes, sleeves, conduits, etc. must be fire-stopped with a fire-rated firestop system providing an air tight seal.

2. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA Representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.

3. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed

2.3 MONITORING, INSPECTION AND TESTING

A. General:

1. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the Employee exposure to asbestos must not exceed 0.1 fibers per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples inside the building, but outside the regulated area. Inside the building, but outside the regulated area air samples shall be collected in the Clean Room of the PDF, at the approximate location of HEPA exhaust discharge, and at a minimum of three (3) locations in areas immediately outside the regulated work area to satisfy this specification. Additional inspection and testing requirements are also indicated in other parts of this specification.

2. The General Contractor will employ an independent industrial hygienist (VPIH/CIH) consultant perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients,

employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the General Contractor including any repeat of final inspection and testing that may be required due to unsatisfactory initial results.

3. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's Representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH/CIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's Representative

B. Scope of Services of the VPIS/CIH Consultant:

1. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the regulated area; and assure clearance at the end of the project. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:

   a. Task 1: May background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
   b. Task 2: Perform Representative air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
   c. Task 3: Perform unannounced visits inside the regulated work area to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.

d. Task 4: Provide support to the VA Representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.

e. Task 5: Perform, in the presence of the VA Representative, final inspection and testing of a decontaminated regulated area at the conclusion of the abatement to certify compliance with all regulations and VA requirements/specifications.

f. Task 6: Issue a final abatement monitoring project report.

2. All documentation, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.

3. The monitoring and inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

C. Monitoring, Inspection and Testing by Contractor CPIH/CIH: The Contractor's CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor's personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH Technician shall have successfully completed a NIOSH 582 Course or equivalent and provide documentation. The IH Technician shall participate in the AIHA Asbestos Analysis Registry or participate in the Proficiency Analytical Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and area samples and have experience in substantially similar projects in size and scope. The analytical laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT and approved by the VA prior to start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for personal and area air monitoring for asbestos in 29 CFR 1926.1101 (f), (g) and Appendix A. This log shall be made available to the VA Representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each Representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. No fewer than two (2) personal air samples or 25 percent of

Representative workforce per shift shall be collected, whichever is greater, in the regulated area; a minimum of three (3) area air samples at locations inside the building but immediately outside the regulated work area; one (1) area air sample shall be collected daily in the Clean Room of the PDF; and one (1) area air sample shall be collected daily at the approximate location of HEPA exhaust discharge. In addition to the continuous monitoring required, the CPIH/CIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities. Additionally, the CPIH/CIH will monitor and record pressure readings within the containment daily with a minimum of two readings at the beginning and at the end of a shift, and submit the data in the daily report.

2.4 ASBESTOS HAZARD ABATEMENT PLAN

A. The Contractor shall have an established Asbestos Hazard Abatement Plan (AHAP) in printed form and loose leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the procedures to be followed during all phases of the work by the Contractor's personnel. The AHAP must be modified as needed to address specific requirements of this project and the specifications. The AHAP(s) shall be submitted for review and approval to the VA prior to the start of any abatement work. The minimum topics and areas to be covered by the AHAP(s) are:

1. Minimum Personnel Qualifications
2. Emergency Action Plan/Contingency Plans and Arrangements
3. Security and Safety Procedures
4. Respiratory Protection/Personal Protective Equipment Program and Training
5. Medical Surveillance Program and Recordkeeping
6. Regulated Area Requirements - Containment Barriers/Isolation of Regulated Area
7. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF)
8. Negative Pressure Systems Requirements
9. Monitoring, Inspections, and Testing
10. Removal Procedures for ACM
11. Removal of Contaminated Soil (if applicable)
12. Encapsulation Procedures for ACM
13. Disposal of ACM waste/equipment
14. Regulated Area Decontamination/Clean-up
15. Regulated Area Visual and Air Clearance
16. Project Completion/Closeout

2.5 SUBMITTALS

A. Pre-Start Meeting Submittals:

1. Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:
   a. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
   b. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
   c. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.
   d. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
      1)Supplied air system, negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
      2)Wastewater filtration system, shower system, containment barriers.
      3)Encapsulants, surfactants, hand held sprayers, airless sprayers, glovebags, and fire extinguishers.
      4)Respirators, protective clothing, fall protection and other required personal protective equipment.
      5)Fire safety equipment to be used in the regulated area.
   e. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
   f. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.
   g. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. Area or clearance air monitoring shall be conducted in accordance with EPA AHERA protocols.

h. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.

1)Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; Completion Date

2)List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution

3)List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal and state EPA), penalties, and legal actions taken against the company including the company's officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.

i. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulations. Submit the phone number and doctor/clinic/hospital used for medical evaluations.

1)CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; medical opinion; and current respirator fit test.

2)Competent Person(s)/Supervisor(s): Number; names; last four digits of social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

3)Workers: Numbers; names; last four digits of social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

j. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy

of the AHAP incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and Asbestos Hazard Abatement Plans; copies of monitoring results of the five referenced projects listed and analytical methods used.

k. Rented equipment must be decontaminated prior to returning to the rental agency.

l. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all SDS, and application instructions.

B. Submittals During Abatement:

1. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; Representative air monitoring and results/TWAs/ELs. Submit this information daily to the VA's Representative.

2. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.

a. Removal of any poly barriers.

b. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant.

c. Packaging and removal of ACM waste from regulated area.

d. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's Representative on a weekly basis.

C. Submittals at Completion of Abatement: The CPIH/CIH shall submit a project report consisting of the daily log book requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area samples must be submitted. The VA Representative will retain the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

PART 3 - EXECUTION

3.1 PRE-ABATEMENT ACTIVITIES

A. Pre-Abatement Meeting: The VA Representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH/CIH that all materials and equipment required for the project are on the site, will arrange for a pre-abatement meeting between the

Contractor, the CPIH/CIH, Competent Person, the VA Representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/documentation to the VA's Representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's Representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.

B. Pre-Abatement Inspections and Preparations:

1. Before any work begins on the construction of the regulated area, the Contractor will:

   a. Conduct a space-by-space inspection with an authorized VA Representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.

   b. The VA Representative, the Contractor, and the VPIH/CIH must be aware of AEQA 10-95 indicating the failure to identify asbestos in the areas listed as well as common issues when preparing specifications and contract documents. This is especially critical when demolition is planned, because AHERA surveys are non-destructive, and ACM may remain undetected. A NESHAP (destructive) ACM inspection should be conducted on all building structures that will be demolished. Ensure the following areas are inspected on the project: Lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside utility chases/walls; cementitious (transite™) piping/ductwork/sheets; behind radiators; lab fume hoods; cementitious (transite™) lab countertops; roofing materials; below window sills; water/sewer lines; electrical conduit coverings; crawl spaces(previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; and steam line trench coverings.

   c. Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination.

   d. If present and required, remove and dispose of carpeting from floors in the regulated area. If carpet comes up without disturbing ACM flooring material, the carpet can be disposed of as C&D waste. If ACM floor tile is attached to the carpet while the Contractor is removing the carpet, that section of the carpet will be disposed of as asbestos waste.

   e. Inspect existing firestopping in the regulated area. Correct as needed.

C. Pre-Abatement Construction and Operations:

1. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
2. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's Representative when the work is completed in accordance with this specification. The VA's Representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP, especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for respiratory protection and the negative pressure system shall be demonstrated for proper performance.
3. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's Representative.
4. Upon satisfactory inspection of the installation of and operation of systems the VA's Representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification and all applicable regulations

3.2 REGULATED AREA PREPARATIONS

A. OSHA DANGER Signs: Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.

B. Controlling Access to the Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF), if required. All other means of access shall be eliminated and OSHA Danger demarcation signs posted as required by OSHA. If the regulated area is adjacent to or within view of an occupied area, provide a visual barrier of 6-mil opaque fire-retardant poly sheeting to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid.

C. Shut Down – Lock Out Electrical: Shut down and lock out/tag out electric power to the regulated area. Provide temporary power and lighting. Ensure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.

D. Shut Down – Lock Out HVAC: Shut down and lock out/tag out heating, cooling, and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Investigate the regulated area and agree on pre-abatement condition with the VA's Representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2 layers of independently installed 6-mil poly. Also, seal any seams in system components that

pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil polyethylene disposal bags for staging and eventual disposal as asbestos waste.

E. Sanitary Facilities: The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.

F. Water for Abatement: The VA will provide water for abatement purposes. The Contractor shall connect to the existing VA system. The service to the shower(s) shall be supplied with backflow prevention.

G. Preparation Prior to Sealing Off: Place all tools, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. Remove all uncontaminated removable furniture, equipment and/or supplies from the regulated area before commencing work, or completely cover with 2-layers of 6-mil fire retardant poly sheeting and secure with duct tape.

H. Critical Barriers: Completely separate any openings into the regulated area from adjacent areas using fire retardant poly at least 6-mils thick and duct tape. Individually seal with 2-layers of independently installed 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects in the regulated area. Heat must be shut off any objects covered with poly.

I. Floor Barriers: If floor removal is not being done, all floors in the regulated area shall be covered with 2-layers of 6-mil fire retardant poly and brought up the wall 24 inches.

J. Pre-Cleaning Movable Objects:

1. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.

2. Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location. and are the only ACM present.

K. Pre-Cleaning Fixed Objects:

1. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area.

2. Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums and/or wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with 2-layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must remain in the regulated area and that require special ventilation or enclosure

requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.

L. Pre-Cleaning Surfaces in the Regulated Area:

1. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area.
2. Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos-containing materials during this pre-cleaning phase.

M. Extension of the Regulated Area: If the regulated area barrier is breached in any manner that could allow the passage of asbestos fibers or debris, the Competent Person shall immediately stop work, continue wetting, and proceed to extend the regulated area to enclose the affected area as per procedures described in this specification. If the affected area cannot be enclosed, decontamination measures and cleanup shall start immediately. All personnel shall be isolated from the affected area until decontamination/cleanup is completed as verified by visual inspection and air monitoring. Air monitoring at completion must indicate background levels.

3.3 REMOVABLE OF CLASS II FLOORING AND MASTIC, MATERIALS

A. General: All applicable requirements of OSHA, EPA, and DOT shall be followed during Class II work. Keep materials intact to the extent feasible; wet while working with it; wrap as soon as possible with 2-layers of 6-mil plastic for disposal.

B. Removal of Flooring Materials:

1. All requirements of OSHA Flooring agreement provisions shall be followed:
   a. The Contractor shall provide enough HEPA negative air machines to effect > -0.02 inches WCG pressure. Provide a standby unit in the event of machine failure and/or emergency in an adjacent area. The contractor shall use double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2 inches pressure drop across the filters.
   b. Flooring shall be removed intact, as much as feasible. Do not rip or tear flooring.
   c. Mechanical chipping or sanding is not allowed.
   d. Flooring may be removed with an infra-red heating unit operated by trained personnel following the manufacturer’s instructions.
   e. Wet clean and HEPA vacuum the floor before and after removal of flooring.
   f. All waste must be contained in the regulated area.
   g. Package all waste in 6-mil poly lined fiberboard drums or double bag in 6-mil polyethylene bags.

C. REMOVAL OF MASTIC

1. 1. Work must be completed under negative pressure with an attached decontamination unit (same as floor tile removal). All chemical mastic removers must be low in volatile organic compound (VOC) content, have a flash point greater than 200 degrees Fahrenheit, contain no chlorinated solvents, and comply with California Air Resources Board (CARB) thresholds for VOCs (effective January 1, 2010).
2. Negative air machine as required under flooring removal shall be provided and operated in accordance with this project specification.
3. Follow all manufacturers' instructions in the use of the mastic removal material. Verify that there are no ignition sources in the work area and minimize the amount of mastic removal material used at any given time to eliminate fire hazards and objectionable odors.
4. Package all waste in 6-mil poly lined fiberboard drums or double bag in 6-mil polyethylene bags.

3.4 DISPOSAL OF CLASS II WASTE MATERIAL

A. General: Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging must also be met. Transport will be in compliance with 49 CFR 171–180 regulations. Disposal shall be done at an approved landfill. Disposal of non-friable ACM shall be done in accordance with applicable State and Local regulations.

3.5 PROJECT DECONTAMINATION

A. General:

1. The VA must be notified at least 24 hours in advance of any waste removed from the containment.
2. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.
3. If the asbestos abatement work is in an area which was contaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal and cleanings of the surfaces of the regulated area after the primary barrier removal.
4. If the asbestos abatement work is in an area which was uncontaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal, thus preventing contamination of the building when the regulated area critical barriers are removed.

B. Regulated Area Clearance: Air testing and other requirements which must be met before release of the Contractor and re-occupancy of the regulated area space are specified in Final Testing Procedures

C. Work Description: Decontamination includes the clearance air testing in the regulated area and the decontamination and removal of the enclosures/facilities installed prior to the abatement work including primary/critical barriers, PDF and W/EDF facilities, and negative pressure systems.

D. Pre-Decontamination Conditions:

1. Before decontamination starts, all ACM waste from the regulated area shall be removed, all waste collected and removed, and the secondary barrier of poly removed and disposed of along with any gross debris generated by the work.
2. At the start of decontamination, the following shall be in place:
    a. Critical barriers over all openings consisting of two layers of 6-mil poly which is the sole barrier between the regulated area and the rest of the building or outside.
    b. Decontamination facilities, if required for personnel and equipment in operating condition.

E. Cleaning: Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and HEPA vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications. The negative pressure system shall remain in operation during this time. Additional cleaning(s) may be needed as determined by the CPIH/VPIH/CIH.

3.6 VISUAL INSPECTION AND AIR CLEARANCE TESTING

A. General: Notify the VA Representative 24 hours in advance for the performance of the final visual inspection and testing. The final visual inspection and testing will be performed by the VPIH/CIH after the final cleaning.

B. Visual Inspection: Final visual inspection will include the entire regulated area, the PDF, all poly sheeting, seals over HVAC openings, doorways, windows, and any other openings. If any debris, residue, dust or any other suspect material is detected, the final cleaning shall be repeated at no additional cost to the VA. Dust/material samples may be collected and analyzed at no additional cost to the VA at the discretion of the VPIH/CIH to confirm visual findings. When the regulated area is visually clean the final testing can be done

C. Air Clearance Testing:

1. After an acceptable final visual inspection by the VPIH/CIH, the VPIH/CIH will perform the final clearance testing. Air samples will be collected and analyzed in accordance with procedures for AHERA in this specification. If work is less than 260 lf/160 sf/35 cf, 5 PCM samples shall be collected for clearance and a minimum of two field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA presented in this specification. If the release criteria are not met, the Contractor shall repeat the final cleaning and continue decontamination procedures until clearance is achieved. **All Additional inspection and testing costs will be borne by the Contractor.**
2. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

D. Final Air Clearance Procedures:

1. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured by the AHERA PCM protocol and $\leq$ 70 AHERA asbestos structures per square millimeter (s/mm^2) by AHERA TEM. No averaging of results will be used for this project. All five (5) TEM samples inside the regulated area shall be at or below 70 asbestos s/mm^2 to satisfy the project final clearance criteria.
2. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures.
    a. Fibers Counted: “Fibers” referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.
    b. Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques. Samples will be collected on 0.8µ MCE filters for PCM analysis and 0.45µ MCE for TEM. A minimum of 1,200 Liters of air using calibrated sampling pumps shall be collected for PCM samples and a minimum of 1,200 Liters of air using calibrated sampling pumps shall be collected for TEM clearance samples. Before pumps are started, initiate aggressive air mixing sampling as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). Air samples will be collected in areas subject to normal air circulation away from corners, obstructed locations, and locations near windows, doors, or vents. After air sampling pumps have been shut off, circulating fans shall be shut off. The negative pressure system shall continue to operate.

3.7 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

A. Completion of Abatement Work:

1. After thorough decontamination, complete asbestos abatement work upon meeting the regulated area clearance criteria and fulfilling the following:
    a. Remove all equipment, materials, and debris from the project area.
    b. Package and dispose of all asbestos waste as required.
    c. Repair or replace all interior finishes damaged during the abatement work.
    d. Fulfill other project closeout requirements as specified elsewhere in this specification

B. Certificate of Completion by Contractor: The CPIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area.

C. Work Shifts: All work shall generally be done during administrative hours (8:00 AM to 4:30 PM) Monday - Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative.

ATTACHMENT #1
CERTIFICATE OF COMPLETION

DATE: _____ VA Project #:_____

PROJECT NAME:_____ Abatement Contractor:_____

VAMC/ADDRESS:_____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):
   which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer’s recommendations.

CPIH/CIH Signature/Date:_____

CPIH/CIH Print Name:_____

Abatement Contractor Signature/Date:_____

Abatement Contractor Print Name:_____

ATTACHMENT #2
CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME:_____DATE:_____

PROJECT ADDRESS:_____

ABATEMENT CONTRACTOR'S NAME:_____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate of worker's acknowledgement you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32-hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

Physical Characteristics and Background Information on Asbestos
Potential Health Effects Related to Exposure to Asbestos
Employee Personal Protective Equipment
Establishment of a Respiratory Protection Program
State of the Art Work Practices
Personal Hygiene
Additional Safety Hazards
Medical Monitoring
Air Monitoring
Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature:_____

Printed Name:_____

Social Security Number (last 4 digits):_____

Witness:_____

ATTACHMENT #3
AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER:_____

VA MEDICAL FACILITY:_____

ABATEMENT CONTRACTOR'S NAME AND ADDRESS:_____

1. I verify that the following individual

Name:_____ Social Security Number:
_____who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.

Address:_____

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH:_____ Date:_____

Printed Name of CPIH/CIH:_____

Signature of Contractor:_____ Date:_____

Printed Name of Contractor:_____

ATTACHMENT #4
ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location:_____

VA Project #:_____

VA Project Description:_____

1. This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

2 I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

3. At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature_____Date_____

- - - E N D - - -

SECTION 02 82 13.31
ASBESTOS TRANSITE-TYPE ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY OF THE WORK

A. Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Asbestos Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred due to such action are also the responsibility of the Asbestos Abatement Contractor.

B. Extent of Work:

1. Below is a brief description of the estimated quantities of asbestos Transite-type materials to be abated. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy himself as the actual quantities to be abated. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.
2. Removal, clean-up and disposal of ACM Transite-type in an appropriate regulated area in the following approximate quantities;

Material Description	Material Location(s)	Estimated Quantity
Transite Ceiling Panels above Room 104	Room 104 Ceiling	400 Square Feet
Tan Interior Door Caulking	1st Floor Northwest Entrance	5 SF (of caulking) or 1 Door

The General Contractor, not the asbestos abatement contractor, shall retain the services of an independent third-party consultant appropriately experienced and trained/licensed to conduct the onsite abatement VPIH/CIH monitoring services for the duration of the abatement as outlined in this specification. The abatement contractor shall be responsible for their own CPIH/CIH services outline in this specification.

C. Related Work:

1. Section 07 84 00, FIRESTOPPING.
2. Section 02 41 00, DEMOLITION.
3. Section 02 82 11, Traditional Asbestos Abatement
4. Section 02 82 13.13, Glovebag Asbestos Abatement
5. Section 02 82 13.19, Asbestos Floor Tile and Mastic Abatement
6. Section 02 83 33.13, Lead-Based Paint Removal and Disposal
7. Division 09, FINISHES

D. Tasks:

1. The work tasks are summarized briefly as follows:
   a. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, regulated area preparations, emergency procedures arrangements, and standard operating procedures for asbestos abatement work.
   b. Abatement activities including removal, clean-up, and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.
   c. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.
   d. NOTE: The VPIH/CIH services shall be performed by an independent consultant hired by the GENERAL CONTRACTOR (NOT THE ABATEMENT CONTRACTOR) as further described in specification.

E. Abatement Contractors Use of Premises:

1. The Contractor and Contractor's personnel shall cooperate fully with the VA Representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.
2. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedure. VA Design and Construction Procedure drawings of partially occupied buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA Representative through the pre-abatement plan of action.

1.2 VARIATIONS IN QUANTITY

A. The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy

of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 10 percent) in quantities of ACM within the regulated area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered ACM and those prices shall be used for additional work required under the contract.

1.3 STOP ASBESTOS REMOVAL

A. If the Contracting Officer; their field Representative; the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal Stop Asbestos Removal Order, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed ACM. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor's competent person to the VA Contracting Officer or field Representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as it is practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities:

1. Airborne PCM analysis results equal to or greater than 0.01 f/cc above background levels inside the building but outside the regulated area;
2. breach or break in regulated area containment barrier(s);
3. less than –0.02 inch WCG pressure in the regulated area;
4. serious injury/death at the site;
5. fire/safety emergency at the site;
6. respiratory protection system failure;
7. power failure or loss of wetting agent; or
8. any visible emissions observed outside the regulated area; or
9. failure to follow project specification requirements.

1.4 DEFINITIONS

A. General: Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents, but are general for the work to the extent they are not stated more

explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

B. Glossary:

Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, encapsulation, enclosure, demolition, and renovation activities related to asbestos containing materials (ACM).

Adequately wet - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.

Aerosol - Solid or liquid particulate suspended in air.

Aggressive method - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.

Aggressive air sampling - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.

AHERA - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.

Aircell - Pipe or duct insulation made of corrugated cardboard which contains asbestos.

Air monitoring - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 3, Fifth Edition is used to determine the fiber levels in air. For personal samples, area air samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis, the NIOSH Method 7402 (Issue 2, Fourth Edition) can be used when it is necessary to confirm fibers counted by PCM as being asbestos. The AHERA TEM analysis may be used for background, area samples and clearance samples when required by this specification, or at the discretion of the VPIH/CIH as appropriate.

Air sample filter - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester (MCE) membrane for PCM (Phase Contrast Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.8 micron pore size) and MCE for TEM (Transmission Electron Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.45 micron pore size).

Amended water - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.

Asbestos - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.

Asbestos Hazard Abatement Plan (AHAP) - Asbestos work procedures required to be submitted by the contractor before work begins.

Asbestos-containing material (ACM) - Any material containing more than one percent of asbestos.

Asbestos contaminated elements (ACE) - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.

Asbestos-contaminated soil (ACS) – Soil found in the work area or in adjacent areas such as crawlspaces or pipe tunnels which is contaminated with asbestos-containing material debris and cannot be easily separated from the material.

Asbestos-containing waste (ACW) material - Asbestos-containing material or asbestos contaminated objects requiring disposal.

Asbestos Project Monitor – Some states require that any person conducting asbestos abatement air sampling, clearance inspections and clearance air sampling be licensed as an asbestos project monitor.

Asbestos waste decontamination facility - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of asbestos waste. Used as the exit for waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel.

Authorized person - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.

Authorized visitor - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA).

Barrier - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.

Containment Barrier - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.

Critical Barrier - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of 2-layers of 6-mil independently installed plastic sheeting (Polyethylene) secured in place at openings such as doors, windows, penetrations or any other opening into the regulated area.

Primary Barrier – Plastic barriers placed over critical barriers and exposed directly to abatement work or to secondary barrier.

Secondary Barrier - Any additional plastic barriers used to isolate and provide protection from debris during abatement work.

Breathing zone - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.

Bridging encapsulant - An encapsulant that forms a layer on the surface of the ACM.

Building/facility owner - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.

Bulk testing - The collection and analysis of suspect asbestos containing materials.

Certified Industrial Hygienist (CIH) - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.

Class I asbestos work - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).

Class II asbestos work - Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.

Clean room/Changing room - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.

Clearance sample - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's Professional Industrial Hygiene consultant/Certified Industrial Hygienist (VPIH/CIH).

Closely resemble - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

Competent person - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.

Contractor's Professional Industrial Hygienist (CPIH/CIH) - The asbestos abatement contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of a PIH and may report to a certified industrial hygienist (CIH).

Count - Refers to the fiber count or the average number of fibers greater than five microns in length with a length-to-width (aspect) ratio of at least 3 to 1, per cubic centimeter of air.

Crawlspace – An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain asbestos materials and/or asbestos contaminated soil.

Decontamination area/unit - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

Demolition - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

Disposal bag - Typically 6-mil thick sift-proof, dustproof, leak-tight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.

Disturbance – Asbestos Operations and Maintenance Activities (OSHA Class III) that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or disposal bag, which shall not exceed 60 inches in length or width.

Drum - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.

Employee exposure - The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.

Encapsulant - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.

Encapsulation - Treating ACM with an encapsulant.

Enclosure - The construction of an air tight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.

Equipment room - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

Fiber - A particulate form of asbestos, 5 microns or longer, with a length to width (aspect) ratio of at least 3 to 1.

Fibers per cubic centimeter (f/cc) - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.

Filter - Media used in respirators, vacuums, or other machines to remove particulate from air.

Firestopping - Material used to close the open parts of a structure in order to prevent a fire from spreading.

Friable asbestos containing material - Any material containing more than one (1) percent asbestos as determined using the method specified in 40 CFR 763, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

Glovebag - Not more than a 60 x 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.

High efficiency particulate air (HEPA) filter – An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

HEPA vacuum - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.

Homogeneous area - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.

HVAC - Heating, Ventilation and Air Conditioning

Industrial hygienist (IH) - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).

Industrial hygienist technician (IH Technician) - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned. Some states require that an industrial hygienist technician conducting asbestos abatement air sampling, clearance inspection and clearance air sampling be licensed as an asbestos project monitor.

Intact - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Lockdown - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.

National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA's rule to control emissions of asbestos to the environment (40 CFR part 61, Subpart M).

Negative initial exposure assessment - A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL or Excursion Limit (EL).

Negative pressure - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02 inch water column gauge inside the negative pressure enclosure.

Negative pressure respirator - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.

Non-friable ACM - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Organic vapor cartridge - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.

Outside air - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.

Owner/operator - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

Penetrating encapsulant - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.

Permissible exposure limit (PEL) - The level of exposure OSHA allows for as an eight (8) hour time-weighted average (TWA). For asbestos fibers, the eight (8) hour time-weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit (EL) is 1.0 fibers per cubic centimeter (1 f/cc).

Personal protective equipment (PPE) – equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, fall protection, and respirators.

Personal sampling/monitoring - Representative air samples obtained in the breathing zone for one or more workers within the regulated area using a filter cassette and a calibrated air sampling pump to determine asbestos exposure.

Pipe tunnel – An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, debris or asbestos-contaminated soil.

Polarized light microscopy (PLM) - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type of asbestos present in a bulk sample.

Polyethylene sheeting - Strong plastic barrier material 4 to 6-mils thick, semi-transparent, flame retardant per NFPA 241.

Positive/negative fit check - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator, respectively.

Presumed ACM (PACM) - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge, or should have known through the exercise of due diligence that other materials are ACM, they too must be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (k)(5).

Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH/CIH) or Contractor's PIH (CPIH/CIH).

Project designer - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Subpart E, Appendix C, Part I; (B)(5).

Assigned protection factor - A value assigned by OSHA/NIOSH to indicate the expected protection provided by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.

Qualitative fit test (QLFT) - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.

Quantitative fit test (QNFT) - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.

Regulated area - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.

Removal - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.

Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.

Repair - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.

Shower room - The portion of the PDF where personnel shower before leaving the regulated area.

Supplied air respirator (SAR) - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-2018.

Surfacing ACM - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, decorative, fireproofing and other purposes.

Surfactant - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.

Thermal system ACM - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.

Transmission electron microscopy (TEM) - A microscopy method that can identify and count asbestos fibers.

VA Professional Industrial Hygienist (VPIH/CIH) – The Department of Veterans Affairs Professional Industrial Hygienist must meet the qualifications of a PIH, and may report to a Certified Industrial Hygienist (CIH).

VA Representative - The VA official responsible for on-going project work.

VA Total – means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.

Visible emissions - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM/ACS or ACM waste material.

Waste/Equipment decontamination facility (W/EDF) – The area in which equipment is decontaminated before removal from the regulated area.

Waste generator - Any owner or operator whose act or process produces asbestos-containing waste material.

Waste shipment record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

Wet cleaning - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

C. Referenced Standards Organizations: See Section 01 42 19 REFERENCED STANDARDS.

1.5 APPLICABLE CODES AND REGULATIONS

A. General Applicability of Codes, Regulations, and Standards:

1. All work under this contract shall be done in strict accordance with all applicable Federal, State, and Local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.
2. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.
3. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system and/or the Contractor's on-site Field

Office. These standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 may be made available electronically.

B. Contractor Responsibility: The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE) including respiratory protection, and respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Contractor will incur all costs of the CPIH/CIH, including all sampling/analytical costs to assure compliance with OSHA/EPA/State/Local requirements related to failure to comply with the regulations applicable to the work.

C. Federal Requirements:

1. Federal requirements which govern asbestos abatement include, but are not limited to, the following regulations:
   a. Occupational Safety and Health Administration **(OSHA)**
      1) Title 29 CFR 1926.1101 - Construction Standard for Asbestos
      2) Title 29 CFR 1926 Subpart E - Personal Protective Equipment and Life Saving Equipment
      3) Title 29 CFR 1910.134 - Respiratory Protection
      4) Title 29 CFR 1926 - Construction Industry Standards
      5) Title 29 CFR 1926.33 - Access to Employee Exposure and Medical Records
      6) Title 29 CFR 1926.59 same as 1910.1200 - Hazard Communication
      7) Title 29 CFR 1926 Subpart C – General Safety and Health Provisions and Subpart D – Occupational Health and Environmental Controls
   b. Environmental Protection Agency **(EPA)**:
      1) 40 CFR 61 Subpart M - National Emission Standard for Hazardous Air Pollutants - Asbestos.
      2) 40 CFR 763 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos Hazard Abatement Reauthorization Act (ASHARA)
   c. Department of Transportation **(DOT)**
      1) Title 49 CFR 171 - 180 – Transportation

D. State Requirements:

1. State requirements that apply to the asbestos abatement work, disposal, clearance, etc., include, but are not limited to, the following:

2. The Ohio Administrative Code (OAC) 3745-20 contains regulations for controlling asbestos emissions from demolition and renovation projects. Ohio's regulations are consistent with U.S. EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) regarding asbestos. The regulations require that contractors do several things, such as provide a notification, conduct thorough inspections to determine the presence of asbestos, follow specific work practices, and ensure proper disposal of asbestos-containing material.
3. The Ohio EPA asbestos program licenses and certifies companies and persons directly involved with the asbestos abatement industry. OAC 3745-22 contains regulations pertaining to contractors performing asbestos removal projects, project supervisors, project designers, workers removing asbestos, persons inspecting buildings for asbestos-containing materials and developing plans to manage asbestos found in a facility, persons conducting air sampling for asbestos and the companies that provide required asbestos training. The asbestos program ensures the safety and quality of asbestos services by requiring persons to take approved training that is specific to the asbestos related activities in which they will be involved and by inspecting/auditing the activities of the program participants.

E. Local Requirements:
1. If local requirements are more stringent than federal or state standards, the local standards are to be followed.
2. Montgomery County, Ohio Regulation 150.

F. Standards:
1. Standards which govern asbestos abatement activities include, but are not limited to, the following:
   a. American National Standards Institute (ANSI)/ASSP Z9.2-2018 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI/ASSE Z88.2-2015 - Practices for Respiratory Protection.
   b. Underwriters Laboratories (UL) 586-2009 - UL Standard for Safety of HEPA Filter Units, 9th Edition; ANSI Approval 2017-12-19.
2. Standards which govern encapsulation work include, but are not limited to the following:
   a. American Society for Testing and Materials International(ASTM)
3. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
   a. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
   b. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
   c. NFPA 101 - Life Safety Code

G. EPA Guidance Documents:

1. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference.
2. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024
3. Asbestos Waste Management Guidance EPA 530-SW-85-007
4. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001
5. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990

H. Notices:

State and Local agencies: Send written notification as required by State and Local regulations including the Local fire department prior to beginning any work on ACM as follows:Submit prior abatement notification to the Ohio EPA at least 10-business days prior to start of work. Ohio EPA notifications can be completed online at www.ebiz.epa.ohio.gov.

Copies of notifications shall be submitted to the VA for the facility's records in the same time frame notification are given to EPA, State, and Local authorities.

I. Permits/Licenses: The contractor shall apply for and have all required permits and licenses to perform asbestos abatement work as required by Federal, State, and Local regulations.

J. Posting and Filing of Regulations: Maintain two (2) copies of applicable Federal, State, and Local regulations. Post one copy of each at the regulated area where workers will have daily access to the regulations and keep another copy in the Contractor's office.

K. VA Responsibilities prior to commencement of work:

1. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment and personal possessions to avoid unauthorized access into the regulated area. **Note: Notification of adjacent personnel is required by OSHA in 29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area**.
2. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized, calibration data and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

L. Emergency Action Plan and Arrangements:

1. An Emergency Action Plan shall be developed prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1926, Subpart C, Standard 1926.35 Employee Emergency Action Plans.
2. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area,

must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.

3. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.
4. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.
5. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
   a. For non-life-threatening situations - employees injured or otherwise incapacitated shall be decontaminated following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
   b. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, medical personnel shall remove them from the regulated area if back or neck injury is present, and secure proper medical treatment.
6. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
7. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.
8. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the standard operating procedures during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

M. Pre-Construction Meeting:

1. Prior to commencing the work, the Contractor shall meet with the VA Certified Industrial Hygienist (VPIH/CIH) to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:
   a. Proof of Contractor licensing.

b. Proof the Competent Person(s) is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person(s) shall also be presented.

c. A list of all workers who will participate in the project, including experience and verification of training and accreditation.

d. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.

e. Current medical written opinions for all personnel working on–site meeting the requirements of 29 CFR 1926.1101 (m).

f. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.

g. A copy of the Contractor's Asbestos Hazard Abatement Plan. In these procedures, the following information must be detailed, specific for this project.

1) Regulated area preparation procedures;

2) Notification requirements procedure of Contractor as required in 29 CFR 1926.1101 (d) Multi-Employer Worksites;

3) Decontamination area set-up/layout and decontamination procedures for employees;

4) Abatement methods/procedures and equipment to be used; and

5) Personal protective equipment to be used.

h. At this meeting the Contractor shall provide all submittals as required.

i. Procedures for handling, packaging and disposal of asbestos waste.

j. Emergency Action Plan and Contingency Plan Procedures.

1.6 PROJECT COORDINATION

A. The following are the minimum administrative and supervisory personnel necessary for coordination of the work.

1. Personnel:

a. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's Representatives responsible for compliance with these specifications and all other applicable requirements.

b. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA Representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; last four digits of social security number; qualifications; accreditation card with color picture if required by State; Certificate of Worker's

Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.

c. Minimum qualifications for Contractor and assigned personnel are:

1) The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of Federal (and State or Local as applicable) EPA and OSHA asbestos regulations in the past three (3) years; has adequate liability/occurrence insurance for asbestos work as required by the State; is licensed in applicable State; has adequate and qualified personnel available to complete the work; has comprehensive standard operating procedures for asbestos work; has adequate materials, equipment and supplies to perform the work.

2) The Competent Person has three (3) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.

3) The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have three (3) years of monitoring experience and supervision of asbestos abatement projects; has participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.

4) The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the standard operating procedures of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; has certificate of training/current refresher and State accreditation/license.

d. All personnel shall be in compliance with OSHA construction safety training as applicable and submit certification.

1.7 RESPIRATORY PROTECTION

A. General - Respiratory Protection Program: The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with OSHA requirements found at 29

CFR 1926.1101 and 29 CFR 1910.134. ANSI Standard Z88.2-2015 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c) - Respiratory Protection Program.

B. Respiratory Protection Program Coordinator: The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years of experience coordinating RPP of similar size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

C. Selection and Use of Respirators: The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit or in the onsite Contractor’s office, for reference by employees or authorized visitors.

D. Minimum Respiratory Protection: Minimum respiratory protection shall be a ½-mask negative pressure air purifying respirator equipped with P100 filters, provided personal air samples in the workplace remain at or below 0.1 f/cc, determined as an 8-hour TWA. Full face powered air purifying respirator equipped with P100 filters shall be required until Contractor demonstrates that personal air samples are at or below 0.1 f/cc, determined as an 8-hour TWA. A higher level of respiratory protection shall be required, if fiber levels exceed 1 f/cc as an 8-hour TWA, inside the regulated work area. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h) and 29 CFR 1910.134 (d)(3)(i)(A) Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

E. Medical Written Opinion: No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

F. Respirator Fit Test: All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Quantitative fit tests shall be done for PAPRs which have been put into a motor/blower failure mode.

G. Respirator Fit Check: The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from entering the regulated area until resolution of the problem.

H. Maintenance and Care of Respirators: The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) Maintenance and care of respirators.

1.8 WORKER PROTECTION

A. Training of Abatement Personnel: Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Initial training certificates and current refresher and accreditation proof must be submitted for each person working at the site.

B. Medical Examinations: Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion that the person has been evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

C. Personal Protective Equipment: Provide whole body clothing, head coverings, foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

D. Regulated Area Entry Procedure: The Competent Person shall ensure that each time workers enter the regulated area, they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

E. Decontamination Procedure: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.

1. When exiting the regulated area, remove all disposable PPE and dispose of in a disposal bag provided in the regulated area.
2. Carefully decontaminate and clean the respirator. Put in a clean container/bag.

F. Regulated Area Requirements: The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for Class II regulated areas at 29 CFR 1926.1101 (e) are met applicable to Class II work and this specification. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

A. Description: Provide each regulated area with a fiber drum with a disposal bag in it for personnel waste materials. The Competent Person shall provide a specific area at the outer boundary of the regulated area and designate it specifically for the decontamination of personnel and respirators.

B. Waste/Equipment Decontamination Area (W/EDA): The Competent Person shall provide a specific area in the regulated area designated for removal of all waste, equipment and contaminated material from the regulated area

C. Waste/Equipment Decontamination Procedures: Contain all waste in 6-mil poly bags or approved equivalent. Clean/decontaminate bags and pass through a double 6-mil flap doorway into another bag or fiber drum. Remove to disposal dumpster/gondola/enclosed vehicle

PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT

2.1 MATERIALS AND EQUIPMENT

A. General Requirements: Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's Representative.

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Critical penetration points into the building shall be sealed with 2-layers of 6-mil independently installed plastic sheeting (Polyethylene) secured in place at openings such as ducts, pipes, windows, louvers, penetrations or any other opening into the regulated area. A drop cloth of 1-layer of 6-mil plastic sheeting will be placed under the work area to capture falling debris and to facilitate clean-up. Fire retardant poly shall be used throughout.
6. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape, poly tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or other effective

procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.

7. Polyethylene sheeting utilized for the PDF, if used, shall be opaque white or black in color, 6-mil fire retardant poly.
8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.
9. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
10. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
11. Disposal bags – Materials shall be wrapped in 2-layers of 6-mil poly for Transite-type waste and shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations. If necessary, materials may be boxed or otherwise packaged to prevent damage to Transite-type waste materials during transport. If boxed or otherwise packaged, appropriate labels shall be affixed to the outer layer of the final container.
12. The VA shall be provided an advance copy of the Safety Data Sheets (SDS) as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-project submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
13. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State and Local regulations shall be posted at the outer boundary of the regulated area or approved equivalent.
14. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

2.2 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA

A. General:

1. Using critical barriers, seal off the regulated area to completely isolate the regulated area from adjacent spaces. All penetrations to the regulated area must be covered with 2-layers of 6-mil fire retardant poly to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated, immediately stop work and clean up the contamination at no

additional cost to the Government. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 2.2.7; FIRESTOPPING.

2. Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects remaining in the regulated area shall be completely covered with 2-layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area.

B. Controlling Access to the Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF), if required. All other means of access shall be eliminated and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to or within view of an occupied area, provide a visual barrier of 6-mil opaque fire retardant poly sheeting to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid.

C. Critical Barriers: Completely separate any operations in the regulated area from adjacent areas using 2-layers of 6-mil fire retardant poly and duct tape. Individually seal with 2-layers of 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.

D. Secondary Barriers: A loose layer of 6-mil poly shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced as needed during the work.

E. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. Decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.

F. Firestopping:

1. Through penetrations caused by cables, cable trays, pipes, ducts, sleeves, conduits, etc. must be fire stopped with a fire-rated firestop system providing an air tight seal.

2. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA Representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.

3. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet

ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed.

2.3 MONITORING, INSPECTION AND TESTING

A. General:

1. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the employee exposure to asbestos must not exceed 0.1 fibers per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and daily area air samples inside the building, but outside the regulated area. At a minimum three (3) perimeter area air samples shall be collected daily inside the building but outside the regulated work area. Additional inspection and testing requirements are also indicated in other parts of this specification.
2. The General Contractor will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the General Contractor except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results.
3. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's Representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH/CIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing,

including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's Representative.

B. Scope of Services of the VPIH/CIH Consultant:

1. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the regulated area; and assure clearance at the end of the project. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:
   a. Task 1: May establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
   b. Task 2: Perform representative air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
   c. Task 3: Perform unannounced visits inside the regulated work areas to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.
   d. Task 4: Provide support to the VA Representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.
   e. Task 5: Perform final inspection and testing of a decontaminated regulated area at the conclusion of the abatement to certify compliance with all regulations and VA requirements/specifications.
   f. Task 6: Issue a final abatement project monitoring report.
2. All documentation, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.
3. The monitoring and inspection results of the VPIH/CIH may be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

C. Monitoring, Inspection and Testing by Contractor CPIH/CIH: The Contractor’s CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor’s personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area

is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH Technician shall have successfully completed a NIOSH 582 Course or equivalent and provide documentation. The IH Technician shall participate in the AIHA Asbestos Analysis Registry or participate in the Proficiency Analytical Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and area samples and have experience in substantially similar projects in size and scope. The analytical laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT and approved by the VA prior to start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for personal and area air monitoring for asbestos in 29 CFR 1926.1101 (f), (g) and Appendix A. This log shall be made available to the VA Representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each Representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. The CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and daily area air samples inside the building, but outside the regulated area. At a minimum three (3) perimeter area air samples shall be collected daily inside the building but outside the regulated work area. In addition to the continuous monitoring required, the CPIH/CIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities.

2.4 ASBESTOS HAZARD ABATEMENT PLAN

A. The Contractor shall have an established Asbestos Hazard Abatement Plan (AHAP) in printed form and loose leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the ways and procedures to be followed during all phases of the work by the contractor's personnel. The AHAP(s) must be modified as needed to address specific requirements of the project. The AHAP shall be submitted for review and approval prior to the start of any abatement work. The minimum topics and areas to be covered by the AHAP(s) are:

1. Minimum Personnel Qualifications
2. Emergency Action Plan and Arrangements
3. Security and Safety Procedures
4. Respiratory Protection/Personal Protective Equipment Program and Training
5. Medical Surveillance Program and Recordkeeping
6. Regulated Area Requirements for Class II work

7. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF)
8. Monitoring, Inspections, and Testing
9. Removal Procedures for Class II Materials
10. Disposal of ACM Waste
11. Regulated Area Decontamination/Clean-up
12. Regulated Area Visual and Air Clearance
13. Project Completion/Closeout

2.5 SUBMITTALS

A. Pre-Start Meeting Submittals:

1. Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:
   a. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
   b. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
   c. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.
   d. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
      1) Negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
      2) Waste water filtration system, shower system, and containment barriers.
      3) Encapsulants, surfactants, hand held sprayers, airless sprayers, and fire extinguishers.
      4) Respirators, protective clothing, fall protection and other required personal protective equipment.
      5) Fire safety equipment to be used in the regulated area.
   e. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.

f. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.

g. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. Area or clearance air monitoring shall be conducted in accordance with EPA AHERA protocols.

h. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.

1) Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; and Completion Date

2) List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution

3) List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal and State and Local EPA), penalties, and legal actions taken against the company including and of the company's officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.

i. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulations. Submit the phone number and doctor/clinic/hospital used for medical evaluations.

1) CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; medical opinion; and current respirator fit test.

2) Competent Person(s)/Supervisor(s): Number; names; last four digits of social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

3) Workers: Numbers; names; last four digits of social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

j. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of SOP's incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and standard operating procedures; copies of monitoring results of the five referenced projects listed and analytical methods used.

k. Rented equipment must be decontaminated prior to returning to the rental agency.

l. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all SDS and application instructions.

B. Submittals During Abatement:

1. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; Representative air monitoring and results/TWAs/ELs. Submit this information daily to the VA’s Representative.

2. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.

a. Removal of any poly barriers.

b. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant, if used.

c. Packaging and removal of ACM waste from regulated area.

d. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's Representative on a weekly basis.

C. Submittals at Completion of Abatement: The CPIH/CIH shall submit a project report consisting of the daily log book requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area samples must be

submitted. The VA Representative will retain the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

PART 3 - EXECUTION

3.1 REGULATED AREA PREPARATIONS

A. Site Security:

1. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and Representatives, State and Local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and be posted in the clean room of the decontamination unit.
2. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent person shall immediately notify the VA Representative.
3. A log book shall be maintained in the clean room of the decontamination unit. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.
4. Access to the regulated area shall be through the PDF or approved equivalent. All other access (doors, windows, hallways, etc.) shall be sealed or locked to prevent entry to or exit from the regulated area. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall <u>not</u> be locked from the inside or outside; however, they shall be sealed with poly sheeting and taped until needed.
5. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24-hour security system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.
6. The Contractor will have the VA's assistance in notifying adjacent personnel of the presence, location and quantity of ACM in the regulated area and enforcement of restricted access by the VA's employees.
7. The regulated area shall be locked during non-working hours and secured by VA Representative or Competent Person. The VA Police shall be informed of asbestos abatement regulated areas to provide security checks during facility rounds and emergency response.

B. OSHA Danger Signs: Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area where airborne concentrations of asbestos may exceed the PEL. Signs shall be posted at a distance sufficiently far enough

away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.

C. Shut down - Lock Out Electric: Shut down and lock out/tag out electric power to the regulated area. Provide temporary power and lighting. Insure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code requirements and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.

D. Shut Down and Lock Out HVAC:

1. Shut down and lock out/tag out heating, cooling, and air conditioning system **(HVAC)** components that are in, supply or pass through the regulated area.
2. Investigate the regulated area and agree on pre-abatement condition with the VA's Representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2-layers of independently installed 6-mil poly. Also, seal any seams in system components that pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil poly disposal bags for disposal as asbestos waste.

E. Negative Pressure Filtration System:

1. The Contractor shall provide enough HEPA negative air machines to continuously maintain a negative pressure differential of -0.02 inch water column gauge (WCG) inside the regulated work area relative to adjacent non-work building areas. OSHA 29 CFR 1926.1101 (g)(5)(i)(A)(2) also requires at least four (4) air changes per hour. The Competent Person shall determine the number of units needed for the regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to continuously maintain a negative pressure differential of -0.02 inch WCG. Provide standby units in the event of machine failure and/or emergency in an adjacent area. HEPA equipped negative air machines shall be discharged outside of the building a minimum of 30 feet from building make-up air, doors, open windows, patients, visitors and staff.
2. NIOSH has done extensive studies and has determined that negative air machines typically operate at ~50 percent efficiency. The contractor shall consider this in their determination of number of units needed to provide -0.02 inch WCG. The contractor shall use 8 air changes per hour or double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2 inches pressure drop across the filters.

F. Containment Barriers and Coverings in the Regulated Area:

1. General: Using critical barriers, seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area must be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated as a result of the work, Contractor shall immediately stop work and clean up

the contamination at no additional cost to the VA. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 2.2.7; FIRESTOPPING.

2. Preparation Prior To Sealing: The Regulated Area: Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects remaining in the regulated area shall be completely covered with 2-layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area.
3. Controlling Access to The Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF), if required. All other means of access shall be eliminated and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to, or within view of an occupied area, provide a visual barrier of 6-mil opaque fire retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.
4. Critical Barriers: Completely separate any operations in the regulated area from adjacent areas using 2-layers of independently installed 6-mil fire retardant poly and duct tape. Individually seal with 2-layers of 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.
5. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. If the affected area cannot be enclosed, decontamination measures and cleanup shall start immediately. All personnel shall be isolated from the affected area until decontamination/cleanup is completed as verified by visual inspection and air monitoring. Air monitoring at completion must indicate background levels.
6. Floor Barriers: If floor removal is not being done, all floors in the regulated area shall be covered with 2-layers of 6-mil fire retardant poly and brought up the wall 12 inches.

G. Personal Protective Equipment: Provide whole body clothing, head coverings, foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

H. Sanitary Facilities: The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.

I. Pre-Cleaning:

1. Pre-Cleaning Moveable Objects:
   a. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.
   b. Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location.
2. Pre-Cleaning Fixed Objects:
   a. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area.
   b. Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums and/or wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with 2-layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must remain in the regulated area and that require special ventilation or enclosure requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.
3. Pre-Cleaning Surfaces in the Regulated Area:
   a. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area.
   b. Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos-containing materials during this pre-cleaning phase.

J. Pre-Abatement Activities:

1. Pre-Abatement Meeting: The VA Representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH that all materials and equipment required for the project are on the site, will arrange for a pre-abatement meeting between the Contractor, the CPIH, Competent Person, the VA Representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing

clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/ documentation to the VA's Representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's Representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.

2. Pre-Abatement Inspections and Preparation:
   a. Before any work begins on the construction of the regulated area, the Contractor will:
      1) Conduct a space-by-space inspection with an authorized VA Representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.
      2) The VA Representative, the Contractor, and the VPIH/CIH must be aware of AEQA 10-95 indicating the failure to identify asbestos in the areas listed as well as common issues when preparing specifications and contract documents. This is especially critical when demolition is planned, because AHERA surveys are non-destructive, and ACM may remain undetected. A NESHAP-compliant (destructive) ACM inspection shall be conducted on all building structures that will be demolished. Ensure the following areas are inspected on the project: Lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside utility chases/walls; Transite-type piping/ductwork/sheets; behind radiators; lab fume hoods; Transite-type lab countertops; roofing materials; below window sills; water/sewer lines; electrical conduit coverings; crawl spaces(previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; steam line trench coverings.
      3) Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination.
      4) Shut down and seal with a minimum of 2-layers of independently installed 6-mil fire retardant poly all HVAC systems and critical openings in the regulated area. The regulated area critical barriers shall completely isolate the regulated area from any other air in the building. The VA's Representative will monitor the isolation provision.
      5) Shut down and lock out in accordance with 29 CFR 1910.147 all electrical circuits which pose a potential hazard. Electrical arrangements will be tailored to the particular regulated area and the systems involved. All electrical circuits affected will

be turned off at the circuit box outside the regulated area, not just the wall switch. The goal is to eliminate the potential for electrical shock which is a major threat to life in the regulated area due to water use and possible energized circuits. Electrical lines used to power equipment in the regulated area shall conform to all electrical safety standards and shall be isolated by the use of a ground fault circuit interrupter (GFCI). All GFCI shall be tested prior to use. The VA's Representative will monitor the electrical shutdown.

6) If required, remove and dispose of carpeting from floors in the regulated area.

7) Inspect existing firestopping in the regulated area. Correct as needed.

3. Pre-Abatement Construction and Operations:

a. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.

b. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's Representative when the work is completed in accordance with this specification. The VA's Representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP(s), especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for respiratory protection and the negative pressure system shall be demonstrated for proper performance.

c. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's Representative.

d. Upon satisfactory inspection of the installation of and operation of systems, the VA's Representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification and all applicable regulations.

3.2 REMOVAL OF CLASS II TRANSITE-TYPE MATERIALS

A. General: All applicable requirements of OSHA, EPA, and DOT shall be followed during Class II work. Keep materials intact; do not break up materials; wet while working with it; wrap as soon as possible with 2-layers of 6-mil plastic for disposal, and maintain good housekeeping in work areas during abatement.

B. Outdoor Work Areas: On some projects, work must be performed on exterior areas of the building. If outdoor work is to be performed, all applicable OSHA, State and Local regulations must be followed to ensure that outdoor work areas are in compliance so that workers, the general public and the environment are protected. Place 6-mil polyethylene sheeting placed 25 feet out from the outer perimeter of the work area to aid in cleaning Transite-type material debris that may fall off building.

C. Scaffold Fall Protection: Each employee more than 6 feet above the base work level shall be protected from falls by guardrails or a fall arrest system. Fall arrest system includes harnesses, components of the harness/belt such as Dee-rings, and snap hooks, lifelines, and anchorage points. Lifelines must be independent of supports lines and suspension ropes and not attached to the same anchorage point as the support or suspension rope. OSHA's scaffolding standard defines a competent person as "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions, which are unsanitary, hazardous to employees, and who has authorization to take prompt corrective measures to eliminate them." The competent person will determine if it is safe for employees to work on or from a scaffold or roof during storms or high winds and to ensure that a personal fall arrest system will protect the employees. The competent person will also inspect the scaffold and scaffold components for visible defects before each work shift and after any occurrence which could affect the structural integrity and to authorize prompt corrective measures.

D. Roof/Elevated Work Area Protection: The competent person shall determine if the walking/working surfaces on which the employees are to work on have the strength and structural integrity to support the employees safely. Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest system.

E. Excavation/Trenching Work Area Protection: Each employee who is working in excavation/trenching work areas to alter or remove materials such as underground piping shall be protected from hazards arising from such work areas. A competent person who is OSHA trained in excavation/trenching operations must be present on site at all time in which work in these areas occurs. The competent person will determine if it is safe for employees to work on or in excavation/trenching work areas and to ensure that all applicable safety measures will protect the employees. The competent person will also inspect the excavation/trenching areas for visible defects before each work shift and after any occurrence which could affect the structural integrity of the excavation/trenching areas and to authorize prompt corrective measures.

F. Removal of Transite-Type:

1. All Transite-type must be wetted prior to removal. Unfasten Transite-type panels without disturbance. Keep Transite-type material intact to the extent feasible.
2. All waste must be wrapped in two layers of 6-mil poly and lowered carefully to the ground.
3. Materials may not be dropped from any height. Unless the material is carried or passed to the ground by hand, it shall be lowered to the ground via covered, dust-tight chute, crane or hoist.

3.3 DISPOSAL OF CLASS II WASTE MATERIAL

A. General: Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging must also be met.

Transport will be in compliance with 49 CFR 171–180 regulations. Disposal shall be done at an approved landfill in accordance with State and Local requirements, which are generally more restrictive than Federal EPA. Disposal of non-friable ACM shall be done in accordance with applicable State and Local regulations.

3.4 PROJECT DECONTAMINATION

A. General:

1. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.
2. If the asbestos abatement work is in an area which was contaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal and cleanings of the surfaces of the regulated area after the primary barrier removal.
3. If the asbestos abatement work is in an area which was uncontaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal, thus preventing contamination of the building when the regulated area critical barriers are removed.

B. Regulated Area Clearance: Air testing and other requirements which must be met before release of the Contractor and re-occupancy of the regulated area space are specified in Final Testing Procedures.

C. Work Description: Decontamination includes the clearance air testing in the regulated area and the decontamination and removal of the enclosures/facilities installed prior to the abatement work including primary/critical barriers, PDF and W/EDF facilities, and negative pressure systems.

D. Pre-Decontamination Conditions:

1. Before decontamination starts, all ACM waste from the regulated area shall be removed, all waste collected and removed, and the secondary barrier of poly removal and disposed of along with any gross debris generated by the work.
2. At the start of decontamination, the following shall be in place:
   a. Critical barriers over all openings consisting of two layers of independently installed 6-mil poly which is the sole barrier between the regulated area and the rest of the building or outside.
   b. Decontamination facilities, if required for personnel and equipment in operating condition.

E. Cleaning: Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and/or HEPA vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications.

The negative pressure system shall remain in operation during this time. Additional cleaning(s) may be needed as determined by the CPIH/VPIH/CIH.

3.5 VISUAL INSPECTION AND AIR CLEARANCE TESTING

A. General: Notify the VA Representative 24 hours in advance for the performance of the final visual inspection and testing. The final visual inspection and testing will be performed by the VPIH/CIH after the cleaning.

B. Visual Inspection: Final visual inspection will include the entire regulated area, all poly sheeting, seals over HVAC openings, doorways, windows, and any other openings. If any debris, residue, dust or any other suspect material is detected, the cleaning shall be repeated at no additional cost to the VA. Dust/ material samples may be collected and analyzed at no additional cost to the VA at the discretion of the VPIH/CIH to confirm visual findings. When the regulated area is visually clean the final testing can be done.

C. Air Clearance Testing:

1. After an acceptable final visual inspection by the VPIH/CIH and VA Representative, the VPIH/CIH will perform the final clearance testing. Air samples will be collected and analyzed in accordance with procedures for AHERA and this specification. If work is less than 260 lf/160 sf/35 cf, 5 PCM samples shall be collected for clearance and a minimum of one field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA and this specification. If the release criteria are not met, the Contractor shall repeat the final cleaning and continue decontamination procedures until clearance is achieved. **All Additional inspection and testing costs will be borne by the Contractor**.
2. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

D. Final Air Clearance Procedures:

1. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured by the AHERA PCM protocol and $\leq$ 70 AHERA asbestos structures per square millimeter (s/mm^2) by AHERA TEM. No averaging of results will be used for this project. All five (5) TEM samples inside the regulated area shall be at or below 70 asbestos s/mm^2 to satisfy the project final clearance criteria.
   a. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures:

1) Fibers Counted: “Fibers” referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.

2) Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques. Samples will be collected on 0.8µ MCE filters for PCM analysis and 0.45µ MCE for TEM. A minimum of 3850 Liters of air using calibrated sampling pumps shall be collected for PCM samples and a minimum of 1200 Liters of air using calibrated sampling pumps shall be collected for TEM clearance samples. Before pumps are started, initiate aggressive air mixing sampling as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). Air samples will be collected in areas subject to normal air circulation away from corners, obstructed locations, and locations near windows, doors, or vents. After air sampling pumps have been shut off, circulating fans shall be shut off. The negative pressure system shall continue to operate.

3.6 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

A. Completion of Abatement Work:

1. After thorough decontamination, complete asbestos abatement work upon meeting the regulated area clearance criteria and fulfilling the following:
   a. Remove all equipment, materials, and debris from the project area.
   b. Package and dispose of all asbestos waste as required.
   c. Repair or replace all interior finishes damaged during the abatement work.
   d. Fulfill other project closeout requirements as specified elsewhere in this specification.

B. Certificate of Completion by Contractor: The CPIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area.

C. Work Shifts:

1. All work shall generally be done during administrative hours (8:00 AM to 4:30 PM) Monday - Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative.
2. Workers will be provided with adequate washing and break area facilities located away from the containment site.

ATTACHMENT #1
CERTIFICATE OF COMPLETION

DATE: _____ VA Project #:_____

PROJECT NAME:_____ Abatement Contractor:_____

VAMC/ADDRESS:_____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):
   which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer’s recommendations.

CPIH/CIH Signature/Date:_____

CPIH/CIH Print Name:_____

Abatement Contractor Signature/Date:_____

Abatement Contractor Print Name:_____

ATTACHMENT #2
CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME:_____DATE:_____

PROJECT ADDRESS:_____

ABATEMENT CONTRACTOR'S NAME:_____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate of worker’s acknowledgement you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32-hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

Physical Characteristics and Background Information on Asbestos
Potential Health Effects Related to Exposure to Asbestos
Employee Personal Protective Equipment
Establishment of a Respiratory Protection Program
State of the Art Work Practices
Personal Hygiene
Additional Safety Hazards
Medical Monitoring
Air Monitoring
Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature:_____

Printed Name:_____

Social Security Number (last 4 digits):_____

Witness:_____

ATTACHMENT #3
AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER:_____

VA MEDICAL FACILITY:_____

ABATEMENT CONTRACTOR'S NAME AND ADDRESS:_____

1. I verify that the following individual
   Name:_____ Social Security Number:_____
   who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.
   Address:_____

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH:_____ Date:_____

Printed Name of CPIH/CIH:_____

Signature of Contractor:_____ Date:_____

Printed Name of Contractor:_____

ATTACHMENT #4
ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location:_____

VA Project #:_____

VA Project Description:_____

This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements.

I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature_____Date_____

- - - E N D - - -

SECTION 02 83 33.13
LEAD-BASED PAINT REMOVAL AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

Paint sampling for lead-content analysis was conducted as a screening for this project by Terracon Consultants, Inc. (Terracon). As result of this testing, it was determined that all painted components associated with Building 120 have paints containing detectable concentrations of lead as determined by laboratory analysis. Therefore, all paints/painted building components must be treated accordingly to this specification as applicable to the work to be completed for the project.

1.2 RELATED WORK

A. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT
B. Section 02 82 13.13, Glovebag Asbestos Abatement
C. Section 02 82 13.19, Asbestos Floor Tile and Mastic Abatement
D. Section 02 41 00, DEMOLITION: Demolition Disturbing Lead-Based Paint.
E. Section 09 91 00, PAINTING: Surface Preparation Disturbing Lead-Based Paint.

1.3 DEFINITIONS

A. Action Level: Employee exposure, without regard to use of respirator, to an airborne lead concentration of 30 micrograms(μ) per cubic meter (m^3) of air determined as an 8-hour Time-Weighted Average (TWA). As used in this section, ”30 micrograms per cubic meter of air" refers to OSHA 29 CFR 1926.62 Lead in Construction Action Level (AL).
B. Area Monitoring: Sampling of lead concentrations within lead control area and inside physical boundaries which are representative of airborne lead concentrations which may reach breathing zone of personnel potentially exposed to lead.
C. Breathing Zone: Area within hemisphere, forward of shoulders, with 150 mm to 225 mm (6 to 9 inches) radius and center at nose or mouth of employee.
D. Certified Industrial Hygienist (CIH): As used in this section, refers to an Industrial Hygienist Certified in the Comprehensive Practice of Industrial Hygiene by the American Board of Industrial Hygiene and Board for Global EHS Credentialing, employed by Contractor.
E. Change Rooms and Shower Facilities: Rooms within designated physical boundary around lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevents cross contamination.
F. Competent Person: Person capable of identifying lead hazards in work area and authorized by contractor to take corrective action. Meets the OSHA definition of Competent Person.
G. Decontamination Room: Room for removal of contaminated personal protective equipment (PPE).
H. Eight-Hour Time Weighted Average (TWA): Airborne concentration of lead averaged over 8-hour workday to which an employee is exposed.

I. High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. HEPA filter means 99.97 percent efficient against 0.3 micron (0.012 mil) size particles.

J. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.

K. Lead Control Area: Enclosed area or structure with full containment to prevent spreading lead dust, paint chips, and debris from lead-based paint removal operations. Lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.

L. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter of air (50 $\mu g/m^3$) determined as an 8-hour TWA as determined by 29 CFR Part 1926.62. When employee is exposed for more than 8-hours per work day, determine PEL by the following formula. PEL micrograms/cubic meter (parts per million) of air = 400/No. of hrs. worked per day.

M. Personnel Monitoring: Sampling of lead concentrations within employee breathing zone to determine 8-hour time weighted average concentration according to 29 CFR Part 1926.62. Take samples that are representative of the various employee's work tasks.

N. Physical Boundary: Area physically roped or partitioned off around enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean same as "outside lead control area."

1.4 APPLICABLE PUBLICATIONS

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

B. American National Standards Institute (ANSI):

Z9.2-2018 ..... Fundamentals Governing the Design & Operation of Local Exhaust Ventilation Systems.

C. Code of Federal Regulations (CFR):

29 CFR Part 1910 ..... Occupational Safety and Health Standards.

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

40 CFR Part 260 ..... Hazardous Waste Management System: General.

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

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

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

40 CFR Part 264 ..... Standards for Owners and Operations of Hazardous Waste Treatment, Storage, and Disposal Facilities.

40 CFR Part 265 ..... Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.

40 CFR Part 268 ..... Land Disposal Restrictions.

49 CFR Part 172 ..... Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements, and Security Plans.

49 CFR Part 178 ..... Specifications for Packaging.

D. Underwriters Laboratories (UL):

586-09 ..... High-Efficiency, Particulate, Air Filter Units.

1.5 PRE-REMOVAL MEETINGS

A. Conduct pre-removal meeting minimum 30 days before beginning Work of this section.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. Certified Industrial Hygienist.
   c. Contractor.
   d. Paint removal contractor.
   e. Other installers responsible for finishing resulting surfaces.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Respiratory protection program.
   b. Hazard communication program.
   c. Hazardous waste management plan.
   d. Safety and health regulation compliance.
   e. Employee training.
   f. Removal schedule.
   g. Removal sequence.
   h. Preparatory work.
   i. Protection before, during, and after removal.
   j. Removal.
   k. Inspecting and testing.
   l. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.6 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.
   a. Paint removal products.
   b. Vacuum filters.
   c. Respirators.
2. Safety Data Sheet for each paint removal product.

3. Installation instructions.
    a. Paint removal products.

C. Test Reports: Submit testing laboratory reports.
1. Submit air monitoring results within three working days, signed by testing laboratory employee performing air monitoring, employee analyzing sample, and CIH.

D. Certificates: Certify completed lead training.
1. Submit certificate for each employee signed and dated by CIH and employee stating employee was trained.

E. Qualifications: Substantiate qualifications comply with specifications.
1. Paint removal contractor.
2. Testing laboratory.
    a. Name, address, and telephone number.
    b. Current evidence of participation in American Industrial Hygiene Association (AIHA) Laboratory Accreditation Program (LAP), LLC, Environmental Lead Laboratory Accreditation Program (ELLAP).
    c. Copy of current AIHA accreditation certificate.
3. Industrial hygienist.
    a. Name, address, and telephone number.
    b. Resume showing previous experience.
    c. Copy of current ABIH CIH certification.
4. Paint disposal facility.
    a. Name, address, and telephone number.
    b. Current license or authorization to receive and dispose lead contaminated waste.

F. Record Documents:
1. Completed and signed hazardous waste manifest from waste transporter.
2. Toxicity Characteristic Leaching Procedure (TCLP) test results to determine if waste is hazardous.
3. Paint disposal facility receipts and disposition reports.
4. Certification of medical examinations.
5. Medical Opinion that employee is qualified to wear a respirator, that employees has been trained and fit tested for the respirator.
6. Employee training certification.

1.7 QUALITY ASSURANCE

A. Safety and Health Regulation Compliance:
1. Comply with laws, ordinances, rules, and regulations of Federal, State, and Local authorities having jurisdiction regarding removing, handling, storing, transporting, and disposing lead waste materials.

a. Comply with applicable requirements of 29 CFR Part 1926.62.

b. Notify Contracting Officer's Representative and request resolution of conflicts between regulations and specified requirements before starting work.

2. Comply with the all applicable local laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing lead-contaminated materials:

B. Paint Removal Contractor: Experienced contractor, registered or licensed by applicable state agency regulating lead-based paint removal.

C. Testing Laboratory: State certified independent testing laboratory experienced in airborne lead monitoring, testing, and reporting.

1. Successful participant in American Industrial Hygiene Association (AIHA) Laboratory Accreditation Program (LAP), LLC, Environmental Lead Laboratory Accreditation Program (ELLAP).

D. Certified Industrial Hygienist: Certified as CIH by American Board of Industrial Hygiene in comprehensive practice and responsible for:

1. Certify Training.

2. Review and approve lead-based paint removal plan for conformance to applicable referenced standards.

3. Inspect lead-based paint removal work for conformance with approved plan.

4. Direct monitoring.

5. Ensure work is performed according to specifications.

6. Ensure personnel and environment hazardous exposures are adequately controlled.

E. Paint Disposal Facility: State certified disposal facility qualified to receive and dispose lead-based paint.

F. Lead-based Paint Removal Plan:

1. Submit detailed, site-specific plan describing lead-based paint removal procedures.

2. Include sketch showing location, size, and details of lead control areas, decontamination rooms, change rooms, shower facilities, and mechanical ventilation system.

3. Include eating, drinking, and restroom procedures, interface of trades, work sequencing, collected wastewater and paint debris disposal plan, air sampling plan, respirators, protective equipment, and detailed description of containment methods ensuring airborne lead concentrations do not exceed action level outside lead control area.

a. Eating, drinking, and smoking are not acceptable within lead control area.

4. Include air sampling, training and strategy, sampling methodology, frequency, duration, and qualifications of air monitoring personnel.

G. Respiratory Protection Program: Establish and implement program required by 29 CFR Part 1910.134 and 29 CFR Part 1926.62.

1. Provide each employee negative pressure or other appropriate respirator.

a. Respirator fit each employee's respirator at initial fitting and at least annually thereafter, as required by 29 CFR Part 1910.134 Respiratory Protection.

H. Hazard Communication Program: Establish and implement program required by 29 CFR Part 1910.1200 which is the same as 29 CFR 1926.59.

I. Hazardous Waste Management Plan: Establish and implement plan according to applicable requirements of Federal, State, and Local hazardous waste regulations including the following:

1. Identification of hazardous wastes associated with work.
2. Estimated quantities of generated and disposed waste.
3. Names and qualifications of each contractor transporting, storing, treating, and disposing wastes. Include facility hazardous waste permits and EPA Identification numbers.
4. Names and qualifications (experience and training) of personnel working on-site with hazardous wastes.
5. List of required waste handling equipment including cleaning, volume reduction, and transport equipment.
6. Spill prevention, containment, and cleanup contingency implementation measures.
7. Work plan and schedule for waste containment, removal, and disposal with daily waste cleaned up and containerization.
8. Hazardous waste disposal cost.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PAINT REMOVAL PRODUCTS

A. Chemical Stripper: Biodegradable, non-toxic, capable of removing existing paint layers in one application, and acceptable to CIH.

2.2 ACCESSORIES

A. Waste Collection Drums: 49 CFR Part 178; Type 1A2, steel, removable head, 200 L (55 gal.) capacity, capable of containing waste without loss.

B. Vacuum Cleaner: HEPA filtered type.

C. Scrapers:

1. Metal type for use on metal, concrete, and masonry surfaces.
2. Plastic type for use on wood, plaster, gypsum board, and other surfaces.

D. Rinse Water: Potable.

E. Cleaning Cloths: Cotton.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before exposure to lead-contaminated dust, provide workers with comprehensive medical examination required by 29 CFR Part 1926.62 (j) Medical Surveillance.

B. Maintain complete and accurate employee medical records according to 29 CFR Part 1910.1020.

C. Train each employee performing paint removal, disposal, and air sampling operations according to 29 CFR Part 1926.62.

1. Certify training is completed before employee is permitted to work on project and enter lead control area.

3.2 PREPARATION

A. Protect existing work indicated to remain.

1. Perform paint removal work without damaging and contaminating adjacent work.
2. Restore damage and contamination to original condition.

B. Notify Contracting Officer 20 days before starting paint removal work.

C. Lead Control Area Requirements:

1. Establish lead control area by completely enclosing lead-based paint removal work area with containment screens.
2. Contain removal operations using negative pressure full containment system with minimum one change room and HEPA filtered exhaust.

D. Boundary Requirements: Provide physical boundaries around lead control area by roping off area or providing curtains, portable partitions or other enclosures to ensure that airborne lead concentrations do not meet or exceed action level outside of lead control area.

E. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems supplying exhausting, and passing through lead control areas. Seal HVAC inlets and outlet within lead control area with 6-mil plastic sheet and tape. Tape seal seams in HVAC components passing through lead control area.

F. Change Room and Shower Facilities: Provide clean change rooms and shower facilities within physical boundary around lead control area according to 29 CFR Part 1926.62.

G. Mechanical Ventilation System:

1. Provide ventilation system to control personnel exposure to lead using HEPA equipped negative air machines.
2. Design, construct, install, and maintain HEPA filtered fixed local exhaust ventilation system according to ANSI Z9.2 and approved by CIH.
3. Exhaust ventilation air to exterior wherever possible.
4. When exhaust ventilation air must be recirculated into work area, provide HEPA filter with reliable back-up filter and controls to monitor lead concentration in return air and to bypass recirculation system automatically when system fails.

H. Personnel Protection: Provide and use required protective clothing and equipment within lead control area.

I. Warning Signs: Provide warning signs complying with 29 CFR Part 1926.62 at lead control area approaches. Locate signs so personnel read signs and take necessary precautions before entering lead control area.

3.3 WORK PROCEDURES

A. Remove lead-based paint according to approved lead-based paint removal plan.
   1. Perform work only in presence of CIH or Industrial Hygienist (IH) Technician under direction of CIH ensuring continuous inspection of work in progress and direction of air monitoring activities.
   2. Handle, store, transport, and dispose lead or and lead contaminated waste according to 40 CFR Part 260, 40 CFR Part 261, 40 CFR Part 262, 40 CFR Part 263, 40 CFR Part 264, and 40 CFR Part 265. Comply with land disposal restriction notification requirements as required by 40 CFR Part 268.

B. Use procedures and equipment required to limit occupational and environmental lead exposure when lead-based paint is removed according to 29 CFR Part 1926.62.

C. Dispose removed paint and waste according to Environmental Protection Agency (EPA), federal, state, and local requirements.

D. Personnel Exiting Procedures:
   1. When personnel exit lead control area, comply with the following procedures:
      a. Vacuum exposed clothing surfaces.
      b. Remove protective clothing and equipment in decontamination room. Place clothing in approved impermeable disposal bag.
      c. Shower.
      d. Dress in clean clothes before leaving lead control area.

E. Monitoring - General:
   1. Monitor airborne lead concentrations according to 29 CFR Part 1910.1025by testing laboratory as directed by CIH.
   2. Take personal air monitoring samples on employees anticipated to have greatest exposure risk as determined by CIH. Additionally, take air monitoring samples on minimum 25 percent of work crew or minimum of two employees, whichever is greater, during each work shift.
   3. Submit results of air monitoring samples, signed by CIH, within 24 hours after taking air samples. Notify Contracting Officer's Representative immediately of lead exposure at or exceeding action level outside of lead control area.

F. Monitoring During Paint Removal:
   1. Perform personal and area monitoring during entire paint removal operation.
   2. Conduct area monitoring at physical boundary daily for each work shift to ensure unprotected personnel are not exposed above action level anytime.

3. For outdoor operations, take at least one sample on each shift leeward of lead control area. When adjacent areas are contaminated, clean area of contamination and have CIH visually inspect and certify lead contamination is cleaned.
4. Stop work when outside boundary lead levels meet or exceed action level. Notify Contracting Officer's Representative, immediately.
5. Correct conditions causing increased lead concentration as directed by CIH.
6. Review sampling data collected during work stoppage to determine if conditions require additional work method modifications as determined by CIH.
7. Resume paint removal when approved by CIH.

3.4 LEAD-BASED PAINT REMOVAL

A. Remove paint within areas indicated on drawings completely exposing substrate. Minimize damage to substrate.

B. Comply with paint removal processes described lead paint removal plan.

C. Lead-Based Paint Removal: Select processes for each application to minimize work area lead contamination and waste.

3.5 SUBSTRATE SURFACE PREPARATION

A. Protect substrates from deterioration and contamination until refinished.

1. Protect metal substrates from flash rusting.

B. Prepare and paint substrates according to Section 09 91 00, PAINTING.

3.6 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

B. Perform sampling and testing for:

1. Air monitoring.
2. Lead-Based Paint.

3.7 CLEANING AND DISPOSAL

A. Cleaning:

1. Maintain lead control area surfaces free of accumulating paint chips and dust. Confine dust, debris, and waste to work area.
2. HEPA vacuum clean and wet wipe with detergent solution work area daily, at end of each shift, and when paint removal operation is complete.

B. CIH Certification: Certify in writing that inside and outside lead control area air monitoring samples are less than action level, employee respiratory protection was adequate, the work was performed according to 29 CFR Part 1926.62, and no visible accumulations of lead-based paint and dust remain on worksite.

1. Do not remove lead control area or roped-off boundary and warning signs before Contracting Officer's Representative's receipt of CIH's certification.

2. Re-clean areas showing dust or residual paint chips.

C. Testing: Where indicated and when directed by Contracting Officer's Representative, test lead-based paint residue and used abrasive according to 40 CFR Part 261 for hazardous waste.

D. Waste Collection:

1. Collect lead-contaminated materials including waste, scrap, debris, bags, containers, equipment, and clothing, which may produce airborne lead contamination.
2. Place lead contaminated materials in waste disposal drums. Label each drum identifying waste type according to 49 CFR Part 172 and date waste materials were first put into drum. Obtain and complete the Uniform Hazardous Waste Manifest forms. Comply with land disposal restriction notification requirements required by 40 CFR Part 268:
3. Coordinate temporary storage location on project site with Contracting Officer's Representative.

E. Waste Disposal:

1. Do not store hazardous waste drums in temporary storage location longer than 90 calendar days from drum label date.
2. Remove, transport, and deliver drums to paint disposal facility.
   a. Obtain signed receipt including date, time, quantity, and description of materials received according to 40 CFR Part 262.
   b. Obtain final report of materials disposition after disposal completion.

- - - E N D - - -

Asbestos Inspection

VA Project: Stabilize/Improve (Building 120)
VA Project Number: 552-19-201
Dayton VA Medical Center (DVAMC)
4100 W Third Street
Dayton, Ohio 45428

February 17, 2023
Terracon Project No. N1227410

Prepared for:
RDC/John Poe Architects, L.L.L.P.
Altamonte Springs, Florida 32701

Prepared by:
Terracon Consultants, Inc.
Cincinnati, Ohio 45226

Terracon

February 17, 2023

RDC/John Poe Architects, L.L.L.P.
524 Fernwood Drive
Altamonte Springs, Florida 32701

Attn: Mr. Mike Duke, AIA, LEED AP
Sr. Project Architect
Cell: (800) 362-1523
E: mduke@rdcjpa.com

Re: Asbestos Inspection Report
VA Project: Stabilize/Improve Building 120
VA Project No. 552-22-102
Dayton VA Medical Center
4100 W. Third Street
Dayton, Montgomery County, Ohio
Terracon Project No. N1227410

Dear Mr. Duke:

Terracon Consultants, Inc. (Terracon) is pleased to submit the attached report for the above-referenced renovation project to RDC/John Poe Architects, L.L.L.P. (Client). The purpose of this report is to present the results of an asbestos inspection, which was performed at the Dayton VA Medical Center's (DVAMC's) Building 120 on January 31, 2023 and in general accordance with our project number PN1227410, dated September 23, 2022. We understand that this inspection was requested for the purpose of a planned renovation project pertaining to potential improvements and stabilization of Building 120 at the DVAMC.

Asbestos-containing materials (ACM) were identified as a result of this inspection regarding Building 120 at the DVAMC. Please refer to the attached report for further detail.

Terracon appreciates the opportunity to provide this service to RDC/John Poe Architects L.L.L.P. If you have any questions regarding this report, please contact the undersigned at 513-321-5816.

Sincerely,
Terracon Consultants, Inc.

Josh Vogel
Group Manager

Joseph A. Tussey, CHMM
Principal

TABLE OF CONTENTS

1.0 INTRODUCTION **1**
1.1 Project Objective 1
1.2 Reliance 1
2.0 PROJECT DESCRIPTION **2**
3.0 FIELD ACTIVITIES **2**
3.1 Visual Assessment 2
3.2 Physical Assessment 2
3.3 Sample Collection 2
3.4 Sample Analysis 3
4.0 REGULATORY OVERVIEW **3**
5.0 FINDINGS AND RECOMMENDATIONS **4**
6.0 LIMITATIONS/GENERAL COMMENTS **5**

APPENDIX A IDENTIFIED ASBESTOS-CONTAINING MATERIALS BY HOMOGENEOUS AREA (HA)

APPENDIX B ASBESTOS INSPECTION SAMPLE & RESULTS SUMMARY

APPENDIX C ASBESTOS ANALYTICAL LABORATORY REPORT

APPENDIX D LICENSES AND CERTIFICATIONS

APPENDIX E SAMPLE & ACM LOCATION DRAWINGS

APPENDIX F PHOTO LOG

APPENDIX G PRIOR REPORT

Terracon

ASBESTOS INSPECTION

VA Project: Stabilize/Improve Chapel Building 120
VA Project No.: 552-22-102
Dayton VA Medical Center (DVAMC)
4100 W Third Street
Dayton, Ohio 45428
Terracon Project No. N1227410
February 17, 2023

1.0 INTRODUCTION

Terracon Consultants, Inc. (Terracon) conducted an asbestos inspection of Building 120 at the Dayton VA Medical Center (DVAMC) prior to renovation activities. The inspection was performed on January 31, 2023, by a United States Environmental Protection Agency (USEPA)-accredited asbestos inspector who was also certified by the Ohio Environmental Protection Agency (OEPA) as an Asbestos Hazard Evaluation Specialist (AHES). Accessible building components were inspected. Homogeneous areas of suspect asbestos-containing materials (ACM) were visually identified and documented. Although reasonable effort was made to inspection accessible suspect materials, additional suspect but un-sampled materials could be located in walls, in voids, or in other concealed areas. Bulk samples from suspect ACM were collected in general accordance with the sampling protocols outlined in USEPA 40 Code of Federal Regulations (CFR) Part 763, Subpart E, known as the Asbestos Hazard Emergency Response Act (AHERA). Samples were delivered to an accredited laboratory for analysis by polarized light microscopy (PLM).

1.1 Project Objective

Terracon understands that the purpose of this inspection was prior to renovation of Building 120 at the DVAMC. Please note that asbestos inspections are required prior to renovation and demolition projects to satisfy requirements of the USEPA 40 CFR Part 61, Subpart M, the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation and Ohio Administrative Code (OAC) 3745-20.

1.2 Reliance

This report is for the exclusive use of RDC/John Poe Architects, L.L.L.P. (Client) for the project being discussed. Reliance by any other party on this report is prohibited without written authorization of Terracon and the Client. Reliance on this report by the Client and all authorized parties will be subject to the terms, conditions, and limitations stated in the proposal and the agreement between Terracon and the Client

2.0 BUILDING DESCRIPTION

Terracon understood the renovation project pertains to potential renovation impacts throughout Building 120 at the DVAMC. The three-story building was reportedly constructed in 1880 and contains approximately 16,8000 square feet of interior floor space with a basement and an attic. The interior walls and ceilings of the building are plaster. The floors are wood with various coverings. The exterior walls of the building are brick, and the roof consists of asphalt shingles.

3.0 FIELD ACTIVITIES

The inspection was conducted by Mr. Lemuel Weyer who is a USEPA-accredited asbestos inspector and OEPA-certified AHES. A copy of his Ohio AHES credential is attached in **Appendix D**. The inspection was conducted in general accordance with the sample collection protocols established in USEPA 40 CFR Part 763, Subpart E, Section 763.86, AHERA. A summary of inspection activities is provided below.

3.1 Visual Assessment

Based on a review of Client-provided drawings, inspection activities were initiated with visual observation of project-specific accessible areas and accessible building components to be impacted by the renovation project to identify homogeneous areas of suspect ACM. A homogeneous area (HA) consists of building materials that appear similar throughout in terms of color and texture with consideration given to the date of application.

3.2 Physical Assessment

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

3.3 Sample Collection

Based on results of the visual observation, bulk samples of suspect ACM were collected in general accordance with USEPA AHERA sampling protocols. Samples of suspect materials were collected from randomly selected locations in each homogeneous area. Bulk samples were collected using wet methods as applicable to reduce the potential for fiber release. Samples were placed in sealable containers and labeled with unique sample numbers using an indelible marker.

The selection of sample locations and frequency of sampling were based on Terracon's observations and the assumption that like materials in the same area are homogeneous in content.

Terracon collected a total of 86 bulk samples from 26 homogeneous areas of suspect ACM associated with Building 120 at the DVAMC. A summary of suspect ACM samples collected during the inspection is included as **Appendix B**.

A prior report for Building 120 was provided and a copy is included in **Appendix G**. Terracon reviewed this report only for positive data, and therefore at the discretion of the inspector, did not re-sample materials that were previously identified positive. However, Terracon verified quantities, locations, and conditions of previously identified positive ACM listed in the prior report and updated these as necessary within this report regarding **Appendix A** (Identified ACM by HA).

3.4 Sample Analysis

Bulk samples were submitted under chain of custody to Eurofins CEI of Cary, North Carolina for analysis by PLM with dispersion staining techniques per USEPA methodology 600/R-93/116. The percentage of asbestos, where applicable, was determined by microscopic visual estimation using PLM. When applicable for samples from friable materials determined by PLM to have a low asbestos-content (<10%), the additional point count (PC) method (400 points) was utilized. Eurofins CEI is accredited under for bulk asbestos analysis under the National Voluntary Laboratory Accreditation Program (NVLAP), accreditation number 101768-1.

The laboratory analytical report is included in **Appendix C**.

4.0 REGULATORY OVERVIEW

The asbestos NESHAP (40 CFR Part 61, Subpart M) regulates asbestos fiber emissions and asbestos waste disposal practices. The asbestos NESHAP regulation also requires the identification and classification of existing ACM according to friability prior to demolition or renovation activity. Friable ACM is a material containing more than 1% asbestos that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. All friable ACM is considered regulated asbestos containing material (RACM).

The asbestos NESHAP regulation classifies material subject to demolition or renovation as either RACM, Category I non-friable ACM, or Category II non-friable ACM. RACM includes all friable ACM (pre-disturbance), along with Category I non-friable ACM that becomes friable (during disturbance), and Category I non-friable ACM subject to sanding, grinding, cutting, or abrading, or Category II non-friable ACM with a high probability of becoming crumbled, pulverized, or reduced to powder by forces expected to act on the material during disturbance. Category I non-friable ACM are exclusively asbestos-containing packings, gaskets, resilient floor coverings, and asphalt roofing products that contain more than 1% asbestos. Category II non-friable ACM are all other non-friable materials (other than Category I non-friable ACM) that contain more than 1% asbestos. Category II non-friable ACM generally includes (but is not limited to) cementitious

material such as: cement pipes, cement siding (Transite™), cement panels, glazing, mortar, and grouts.

The Ohio Environmental Protection Agency (OEPA) adopted Chapter 3745-20 of the Ohio Administrative Code and implements the Asbestos NESHAP. The owner or operator must provide the OEPA district office or local air agency with written notification at least 10 business days prior to the commencement demolition projects and prior to removal of friable ACMs in quantities greater than 50 linear or 50 square feet. The OEPA also regulates friable asbestos abatement activities, asbestos personnel training, and issuance of asbestos professional certifications under OAC 3745-22. OEPA audits asbestos abatement projects and responds to public health emergencies where friable ACMs has been released. Please note that per OEPA regulations, non-friable floor tile if broken into pieces four (4) square inches or smaller are considered friable, and thus as a RACM.

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

5.0 FINDINGS AND RECOMMENDATIONS

Asbestos-containing materials (ACM) were identified as a result of this inspection. Please see Appendix A for table listing the identified ACM along with approximate quantities, locations, NESHAP material categories, and conditions regarding the identified ACM.

A sample and results summary table is included in **Appendix B**, the laboratory analytical report is included in **Appendix C**, drawings indicating sample and ACM locations are included in **Appendix E**, and example photos of the identified materials are included in **Appendix F**.

If the identified ACMs will be impacted by the renovation project, such materials will first need to be properly removed, handled, and disposed by a state-licensed abatement contractor in accordance with applicable federal and state EPA asbestos regulations, Occupational Safety and Health Administration (OSHA) asbestos regulations, and per VA abatement project specifications.

It should be noted that inaccessible/concealed suspect materials, other than those identified during this inspection, may exist. This inspection did not include disassembling equipment or electrical wiring/electrical components as the building was fully active/operational and inspecting/sampling such equipment/materials would representative a safety hazard to the inspector. Should additional

suspect materials be uncovered prior to or during renovation activities, those materials must be assumed asbestos-containing until sampled by a state-licensed asbestos inspector and analysis refutes the positive assumption.

6.0 LIMITATIONS/GENERAL COMMENTS

Terracon did not perform sampling which required demolition or destructive activities such as knocking large holes in walls, dismantling of equipment or removal of protective coverings. Reasonable efforts to access suspect materials within known areas of restricted access (e.g., crawl spaces) were made; however, confined spaces or areas/equipment which may pose a health or safety risk to Terracon personnel were not sampled (inspecting/opening energizing equipment, inspecting/sampling electrical wiring and similar components). Sampling did not include suspect materials which could not be safely reached with available ladders/man-lifts.

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

Terracon

APPENDIX A

VA Project: Stabilize/Improve Building 120
VA Project No.: 552-22-102
Dayton VA Medical Center (DVAMC)
4100 W Third Street
Dayton, Ohio 45428

IDENTIFIED ASBESTOS-CONTAINING MATERIALS BY HOMOGENEOUS AREA (HA)

HA No's.	ACM Description	Material Location	% and Type Asbestos	EPA NESHAP Classification	Condition/ Friability	Estimated Quantity*
03	9"x9" Brown with White Streak Floor Tile with Non-Asbestos-Containing Black Mastic	1st Floor: Southeast Corner of Main Area and South Wing (Under Carpet), North Storage Closet (Room 103B)	7% Chrysotile	Category I Non-Friable	Good/ Non-Friable	1,200 Square Feet (SF)
04	12"x12" White Floor Tile (Bottom Layer) with Non-Asbestos-Containing Black Mastic Beneath Non-Asbestos-Containing 12"x12" White with Gray Steak Floor Tile (Top Layer) and Yellow Mastic	1st Floor Central Restroom	5% Chrysotile	Category I Non-Friable	Good/ Non-Friable	50 SF
11	Tan Interior Door Caulking	1st Floor Northwest Entrance	<1% Chrysotile	Not Regulated by EPA (<1% asbestos); However, Regulated by OSHA	Good/ Non-Friable	5 SF or 1 Door
14	9"x9" Brown Floor Tile with Non-Asbestos-Containing Black Mastic and Brown Floor Leveler	2nd Floor: South Wing	7% Chrysotile	Category I Non-Friable	Good/ Non-Friable	900 SF
** (Prior Report Data)	Pipe Insulation Including Mudded Elbows and Fittings	Associated with Hot Water and Steam Line in Basement of Building (Rooms: 1, 2,3 & 4)	>1% Asbestos Based on Historical Report	Regulated Asbestos-Containing Material (RACM)	Good/Friable	200 Linear Feet
	Black Mastic on Concrete and/or Wood Floors	Rooms: 102, 103	Floor Tile/Mastic: >1% Asbestos Based on Historical Report	Category I Non-Friable	Good/ Non-Friable	1,400 SF
	Cementitious (Transite™) Ceiling Panels	Room 104	Floor Tile/Mastic: >1% Asbestos Based on Historical Report	Category II Non-Friable	Good/ Non-Friable	400 SF
	Textured Paint	Exterior Masonry Walls	Floor Tile/Mastic: >1% Asbestos Based on Historical Report	RACM	Good/ Friable	15,000 SF

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

** Material previously sampled as part of prior inspection report(s). Terracon reviewed previous report(s) and verified condition and quantity of the materials conformed to contain asbestos.

See **Appendix B** for a summary of samples collected with respective analytical results, **Appendix C** for the laboratory analytical report, **Appendix E** for sample and ACM location drawings, and **Appendix F** for photo examples of the above identified materials.

It should be noted that inaccessible/concealed suspect materials, other than those identified during this inspection, may exist. This inspection did not include disassembling equipment or electrical wiring/electrical components as the building was fully active/operational and inspecting/sampling such equipment/materials would representative a safety hazard to the inspector. Should additional suspect materials be uncovered prior to or during renovation activities, those materials must be assumed asbestos-containing until sampled by a state-licensed asbestos inspector and analysis refutes the positive assumption.

If the identified ACMs will be impacted by the renovation, such materials would need to be properly removed, handled, and disposed in accordance with applicable federal and state EPA regulations, Occupational Safety and Health Administration (OSHA) regulations, and per VA project specifications.

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APPENDIX B

VA Project: Stabilize/Improve Building 120
VA Project No.: 552-22-102
Dayton VA Medical Center (DVAMC)
4100 W Third Street
Dayton, Ohio 45428

ASBESTOS INSPECTION SAMPLE & RESULTS SUMMARY

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
01	01	Plaster Walls and Ceilings: Base Coat and Finish Coat	North Wing Closet of 1st Floor	Throughout Building	Base Coat: None Detected (ND)
	02		Near Northwest Corner of 1st Floor		Base Coat: ND, Finished Coat: ND
	03		Ceiling at Center of 2nd Floor		Base Coat: ND, Finished Coat: ND
	04		Southeast Corner Ceiling of 2nd Floor		Base Coat: ND, Finished Coat: ND
	05		At Window in 2nd Floor Restroom		Base Coat: ND, Finished Coat: ND
	06		Ceiling at Doorway to South Wing on 3rd Floor		Base Coat: ND, Finished Coat: ND
	07		Southeast Corner of 3rd Floor		Base Coat: ND, Finished Coat: ND
02	08	Yellow/Black Carpet Mastic	Southeast Corner	Throughout 1st Floor	ND
	09		Northwest Corner		ND
	10		Southwest Corner		ND
03	11	**9"x9" Brown with White Streak Floor Tile** and Black Mastic	**Middle of South Wing**	**1st Floor: Southeast Corner of Main Area and South Wing (Under**	**Floor Tile: 7% Chrysotile,** Mastic: ND
	12		**Southeast Corner**		**Floor Tile: 7% Chrysotile,** Mastic: ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	13		**Southeast Corner**	**Carpet), North Storage Closet (Room 103)**	**Floor Tile: 7% Chrysotile,** Mastic: ND
04	**14**	12"x12" White with Gray Steak Floor Tile (Top Layer) and Yellow Mastic over **12"x12" White Floor Tile (Bottom Layer)** with Black Mastic	**Doorway**	**1st Floor Central Restroom**	Top Floor Tile: ND, Mastic: ND, **Bottom Floor Tile: 5% Chrysotile,** Mastic: ND
	15		**Doorway**		Top Floor Tile: ND, Mastic: ND, **Bottom Floor Tile: 5% Chrysotile,** Mastic: ND
	16		**Southwest Corner**		Top Floor Tile: ND, Mastic: ND, **Bottom Floor Tile: 5% Chrysotile,** Mastic: ND
05	17	White Pipe Encapsulant	Middle East Wall of Basement	Associated with Fiberglass Insulated Pipes throughout the Building	ND
	18		Southwest Corner of 1st Floor		ND
	19		Northwest Corner of Basement		ND
06	20	24"x24" Brown Marble Pattern Floor Tile with Off-White Mortar and Tan Grout	Southwest Corner	West 1st Floor Lobby	Ceramic Tile: ND, Mortar: ND, Grout: ND
	21		Southwest Corner		Ceramic Tile: ND, Mortar: ND, Grout: ND
	22		Southwest Corner		Ceramic Tile: ND, Mortar: ND, Grout: ND
07	23	Multi-Sized White and Black Patterned Ceramic Floor Tile with Gray Mortar and Black Grout	Southwest Corner of Women's Restroom	1st Floor Men's and Women's West Restrooms	Ceramic Tile: ND, Mortar: ND, Grout: ND
	24		Southwest Corner of Women's Restroom		Ceramic Tile: ND, Mortar: ND, Grout: ND
	25		Southwest Corner of Women's Restroom		Ceramic Tile: ND, Mortar: ND, Grout: ND
08	26	3"x6" White Ceramic Wall Tile with Gray Mortar and White Grout	Southeast Corner Women's Restroom	1st Floor Men's and Women's West Restrooms	Ceramic Tile: ND, Mortar: ND, Grout: ND
	27		Southeast Corner Women's Restroom		Ceramic Tile: ND, Mortar: ND, Grout: ND

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Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	28		Southeast Corner Women's Restroom		Ceramic Tile: ND, Mortar: ND, Grout: ND
09	29	12"x12" Brown Ceramic Floor Tile Gray Mortar and Brown Grout	Northwest Corner	1st Floor West Janitor's Closet	Ceramic Tile: ND, Mortar: ND, Grout: ND
	30		Northwest Corner		Grout: ND
	31		Northwest Corner		Ceramic Tile: ND, Mortar: ND, Grout: ND
10	32	12"x12" Brown Ceramic Wall Tile with Gray Mortar and Brown Grout	Middle East Wall	1st Floor West Janitor's Closet	Ceramic Tile: ND, Mortar: ND, Grout: ND
	33		Middle East Wall		Ceramic Tile: ND, Mortar: ND, Grout: ND
	34		Middle East Wall		Ceramic Tile: ND, Mortar: ND, Grout: ND
11	**35**	**Tan Interior Door Caulking**	**East Side**	**1st Floor Northwest Entrance**	**<1% Chrysotile**
	36		**East Side**		**<1% Chrysotile**
	37		**West Side**		**<1% Chrysotile**
12	38	White Interior Door Caulking	East Side	1st Floor Southwest Entrance	ND
	39		East Side		ND
	40		West Side		ND
13	41	Black Rubber Stair Tread and Black Mastic	West Stairwell at Bottom Step	East and West Stairwells, 2nd Floor Walkways	Tread: ND, Mastic: ND
	42		West Stairwell Top Step at 2nd Floor		Tread: ND, Mastic: ND
	43		East Stairwell – Bottom Step		Tread: ND, Mastic: ND

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Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
14	**44**	**9"x9" Brown Floor Tile with Black Mastic and Brown Floor Leveler**	**Northeast Corner**	**2nd Floor: South Wing**	**Floor Tile: 7% Chrysotile**, Mastic: ND, Leveler: ND
	45		**Southeast Corner**		**Floor Tile: 7% Chrysotile**, Mastic: ND, Leveler: ND
	46		**Southwest Corner**		**Floor Tile: 7% Chrysotile**, Mastic: ND, Leveler: ND
15	47	4"x1" Red Ceramic Floor Tile with Gray Mortar	2nd Floor: Northeast Corner	2nd and 3rd Floor Fireplace	Ceramic: ND, Mortar: ND
	48		2nd Floor: Northeast Corner		Ceramic: ND, Mortar: ND
	49		2nd Floor: Northeast Corner		Ceramic: ND, Mortar: ND
16	50	Insulation Debris	Center	Attic	ND
	51		South Wing		ND
	52		North Wing		ND
17	53	Gray Asphalt Shingles with Tar and Tar Paper	At Attic Roof Hatch	Roof	Shingles: ND, Tar Paper: ND
	54		At Attic Roof Hatch		Shingles: ND, Tar Paper: ND
	55		At Attic Roof Hatch		Shingles: ND, Tar Paper: ND
18	56	12"x12" White with Gray Marks Floor Tile and Black Mastic	Southwest Corner of Closet	1st Floor: East Lobby	Floor Tile: ND, Mastic: ND
	57		Southeast Corner of Lobby		Floor Tile: ND Mastic: ND
	58		Bottom of Stairwell		Floor Tile: ND, Mastic: ND
19	59	White Interior Window Caulking	Northwest Corner	Basement Windows	ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	60		Southwest Corner		ND
	61		Southeast Corner		ND
20	62	White Wall Coating/Stabilizer	Southwest Corner	Walls throughout Basement	ND
	63		North Wall of North Wing		ND
	64		Northwest Corner		ND
	65		Southwest Corner		ND
	66		Doorway to South Wing		ND
	67		Southeast Corner		ND
	68		Middle East Wall		ND
21	69	White Floor Leveler	Doorway to South Wing	1st Floor: Under Carpet	ND
	70		North Side of North Wing		ND
	71		Southwest Corner of 1st Floor		ND
22	72	4" Tan Cove Base with Brown and Cream Mastic	Doorway	1st Floor Central Restroom	Cove Base: ND, Brown Mastic: ND, Cream Mastic: ND
	73		Doorway		Cove Base: ND, Brown Mastic: ND, Cream Mastic: ND
	74		Southwest Corner		Cove Base: ND, Brown Mastic: ND, Cream Mastic: ND
23	75	Gray Exterior Door Caulking	Front Door	Front Entrance Doors,	ND

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Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	76		Front Door	Northwest Entrance Doors	ND
	77		Northwest Doorway		ND
24	78	White Exterior Window Glazing	Southeast Corner	Exterior Windows	ND
	79		Southwest Corner		ND
	80		Northwest Corner		ND
25	81	White Exterior Window Caulking over Gray Window Caulking	Southeast Corner	Exterior Windows	ND
	82		Southwest Corner		ND
	83		Northwest Corner		ND
26	84	White Exterior Window Caulking	Southeast Corner	Basement Exterior Windows	ND
	85		Northwest Corner		ND
	86		Northeast Corner		ND

Inspector Signatures: _____
Lem Weyer, OH AHES #36337

APPENDIX C

ASBESTOS ANALYTICAL LABORATORY DATA

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February 16, 2023

Terracon Consultants, Inc.
611 Lunken Park Drive
Cincinnati, OH 45226

CLIENT PROJECT: Building 120 Dayton VAMC, N1227410
CEI LAB CODE: B233493v2

Dear Customer:

Enclosed are asbestos analysis results for PLM Bulk samples received at our laboratory on February 14, 2023. The samples were analyzed for asbestos using polarizing light microscopy (PLM) per the EPA 600 Method.

Sample results containing >1% asbestos are considered asbestos-containing materials (ACMs) per EPA regulatory requirements. The detection limit for the EPA 600 Method is <1% asbestos by weight as determined by visual estimation.

Thank you for your business and we look forward to continuing good relations.

Kind Regards,

Tianbao Bai, Ph.D., CIH
Laboratory Director

NVLAP® TESTING
NVLAP LAB CODE: 600323-0

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ASBESTOS ANALYTICAL REPORT
By: Polarized Light Microscopy

Prepared for

Terracon Consultants, Inc.

CLIENT PROJECT: Building 120 Dayton VAMC, N1227410

LAB CODE: B233493v2

TEST METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

REPORT DATE: 02/16/23

TOTAL SAMPLES ANALYZED: 86

SAMPLES >1% ASBESTOS: 9

2752 Pleasant Rd Suite 100A • Fort Mill, SC 29708 • 803.526.5146

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Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Building 120 Dayton VAMC, N1227410 **LAB CODE: B233493v2**

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
01-01		B233493.01	Tan	Plaster	None Detected
01-02	Layer 1	B233493.02	White	Plaster Skim Coat	None Detected
	Layer 2	B233493.02	Tan	Plaster Base Coat	None Detected
01-03	Layer 1	B233493.03	White	Plaster Skim Coat	None Detected
	Layer 2	B233493.03	Tan	Plaster Base Coat	None Detected
01-04	Layer 1	B233493.04	White	Plaster Skim Coat	None Detected
	Layer 2	B233493.04	Tan	Plaster Base Coat	None Detected
01-05	Layer 1	B233493.05	White	Plaster Skim Coat	None Detected
	Layer 2	B233493.05	Tan	Plaster Base Coat	None Detected
01-06	Layer 1	B233493.06	White	Plaster Skim Coat	None Detected
	Layer 2	B233493.06	Tan	Plaster Base Coat	None Detected
01-07	Layer 1	B233493.07	White	Plaster Skim Coat	None Detected
	Layer 2	B233493.07	Tan	Plaster Base Coat	None Detected
02-08		B233493.08	Yellow,Black	Carpet Mastic	None Detected
02-09		B233493.09	Yellow,Black	Carpet Mastic	None Detected
02-10		B233493.10	Yellow,Black	Carpet Mastic	None Detected
03-11	Layer 1	B233493.11A	Yellow	Mastic	None Detected
	Layer 2	B233493.11A	Brown	9"x9" Floor Tile	Chrysotile 7%
		B233493.11B	Black	Mastic	None Detected
03-12		B233493.12A	Brown	9"x9" Floor Tile	Chrysotile 7%
		B233493.12B	Black	Mastic	None Detected
03-13		B233493.13A	Brown	9"x9" Floor Tile	Chrysotile 7%
		B233493.13B	Black	Mastic	None Detected
04-14		B233493.14A	White,Gray	12"x12" Floor Tile (Type 1)	None Detected
		B233493.14B	Yellow	Mastic	None Detected
		B233493.14C	White	12"x12" Floor Tile (Type 2)	Chrysotile 5%
		B233493.14D	Black	Mastic	None Detected
04-15		B233493.15A	White,Gray	12"x12" Floor Tile (Type 1)	None Detected
		B233493.15B	Yellow	Mastic	None Detected
		B233493.15C	White	12"x12" Floor Tile (Type 2)	Chrysotile 5%
		B233493.15D	Black	Mastic	None Detected

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Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Building 120 Dayton VAMC, N1227410 **LAB CODE: B233493v2**

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
04-16		B233493.16A	White,Gray	12"x12" Floor Tile (Type 1)	None Detected
		B233493.16B	Yellow	Mastic	None Detected
		B233493.16C	White	12"x12" Floor Tile (Type 2)	Chrysotile 5%
		B233493.16D	Black	Mastic	None Detected
05-17		B233493.17	White,Yellow	Pipe Encapsulant	None Detected
05-18		B233493.18	White,Yellow	Pipe Encapsulant	None Detected
05-19		B233493.19	White,Yellow	Pipe Encapsulant	None Detected
06-20*	Layer 1	B233493.20	Tan,Brown	Ceramic Tile	None Detected
	Layer 2	B233493.20	Off-white	Mortar	None Detected
	Layer 3	B233493.20	Tan	Grout	None Detected
06-21*	Layer 1	B233493.21	Tan,Brown	Ceramic Tile	None Detected
	Layer 2	B233493.21	Off-white	Mortar	None Detected
	Layer 3	B233493.21	Tan	Grout	None Detected
06-22*	Layer 1	B233493.22	Tan,Brown	Ceramic Tile	None Detected
	Layer 2	B233493.22	Off-white	Mortar	None Detected
	Layer 3	B233493.22	Tan	Grout	None Detected
07-23	Layer 1	B233493.23	White,Black	Ceramic Tile	None Detected
	Layer 2	B233493.23	Gray	Mortar	None Detected
	Layer 3	B233493.23	Black	Grout	None Detected
07-24	Layer 1	B233493.24	White,Black	Ceramic Tile	None Detected
	Layer 2	B233493.24	Gray	Mortar	None Detected
	Layer 3	B233493.24	Black	Grout	None Detected
07-25	Layer 1	B233493.25	White,Black	Ceramic Tile	None Detected
	Layer 2	B233493.25	Gray	Mortar	None Detected
	Layer 3	B233493.25	Black	Grout	None Detected
08-26	Layer 1	B233493.26	White	Ceramic Tile	None Detected
	Layer 2	B233493.26	Gray	Mortar	None Detected
	Layer 3	B233493.26	White	Grout	None Detected
08-27	Layer 1	B233493.27	White	Ceramic Tile	None Detected
	Layer 2	B233493.27	Gray	Mortar	None Detected
	Layer 3	B233493.27	White	Grout	None Detected

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Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Building 120 Dayton VAMC, N1227410 **LAB CODE: B233493v2**

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
08-28	Layer 1	B233493.28	White	Ceramic Tile	None Detected
	Layer 2	B233493.28	Gray	Mortar	None Detected
	Layer 3	B233493.28	White	Grout	None Detected
09-29	Layer 1	B233493.29	Brown	Ceramic Tile	None Detected
	Layer 2	B233493.29	Gray	Mortar	None Detected
	Layer 3	B233493.29	Brown	Grout	None Detected
09-30		B233493.30	Brown	Grout	None Detected
09-31	Layer 1	B233493.31	Brown	Ceramic Tile	None Detected
	Layer 2	B233493.31	Gray	Mortar	None Detected
	Layer 3	B233493.31	Brown	Grout	None Detected
10-32	Layer 1	B233493.32	Brown	Ceramic Tile	None Detected
	Layer 2	B233493.32	Gray	Mortar	None Detected
	Layer 3	B233493.32	Brown	Grout	None Detected
10-33	Layer 1	B233493.33	Brown	Ceramic Tile	None Detected
	Layer 2	B233493.33	Gray	Mortar	None Detected
	Layer 3	B233493.33	Brown	Grout	None Detected
10-34	Layer 1	B233493.34	Brown	Ceramic Tile	None Detected
	Layer 2	B233493.34	Gray	Mortar	None Detected
	Layer 3	B233493.34	Brown	Grout	None Detected
11-35		B233493.35	Tan	Door Caulking	Chrysotile <1%
11-36		B233493.36	Tan	Door Caulking	Chrysotile <1%
11-37		B233493.37	Tan	Door Caulking	Chrysotile <1%
12-38		B233493.38	White	Door Caulking	None Detected
12-39		B233493.39	White	Door Caulking	None Detected
12-40		B233493.40	White	Door Caulking	None Detected
13-41		B233493.41A	Black	Stair Tread	None Detected
		B233493.41B	Black	Mastic	None Detected
13-42		B233493.42A	Black	Stair Tread	None Detected
		B233493.42B	Black	Mastic	None Detected
13-43		B233493.43A	Black	Stair Tread	None Detected
		B233493.43B	Black	Mastic	None Detected

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Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Building 120 Dayton VAMC, N1227410 **LAB CODE: B233493v2**

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
14-44		B233493.44A	Brown	9"x9" Floor Tile	Chrysotile 7%
	Layer 1	B233493.44B	Black	Mastic	None Detected
	Layer 2	B233493.44B	Brown	Floor Leveler	None Detected
14-45		B233493.45A	Brown	9"x9" Floor Tile	Chrysotile 7%
	Layer 1	B233493.45B	Black	Mastic	None Detected
	Layer 2	B233493.45B	Brown	Floor Leveler	None Detected
14-46		B233493.46A	Brown	9"x9" Floor Tile	Chrysotile 7%
	Layer 1	B233493.46B	Black	Mastic	None Detected
	Layer 2	B233493.46B	Brown	Floor Leveler	None Detected
15-47	Layer 1	B233493.47	Red	Ceramic Tile	None Detected
	Layer 2	B233493.47	Gray	Mortar	None Detected
15-48	Layer 1	B233493.48	Red	Ceramic Tile	None Detected
	Layer 2	B233493.48	Gray	Mortar	None Detected
15-49	Layer 1	B233493.49	Red	Ceramic Tile	None Detected
	Layer 2	B233493.49	Gray	Mortar	None Detected
16-50		B233493.50	Black	Insulation Debris	None Detected
16-51		B233493.51	Black	Insulation Debris	None Detected
16-52		B233493.52	Black	Insulation Debris	None Detected
17-53	Layer 1	B233493.53	Gray,Black	Asphalt Shingle	None Detected
	Layer 2	B233493.53	Black	Tarpaper	None Detected
17-54	Layer 1	B233493.54	Gray,Black	Asphalt Shingle	None Detected
	Layer 2	B233493.54	Black	Tarpaper	None Detected
17-55	Layer 1	B233493.55	Gray,Black	Asphalt Shingle	None Detected
	Layer 2	B233493.55	Black	Tarpaper	None Detected
18-56		B233493.56A	White,Gray	12"x12" Floor Tile	None Detected
		B233493.56B	Black	Mastic	None Detected
18-57		B233493.57A	White,Gray	12"x12" Floor Tile	None Detected
		B233493.57B	Black	Mastic	None Detected
18-58		B233493.58A	White,Gray	12"x12" Floor Tile	None Detected
		B233493.58B	Black	Mastic	None Detected
19-59		B233493.59	White	Window Caulking	None Detected

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Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Building 120 Dayton VAMC, N1227410 **LAB CODE: B233493v2**

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
19-60		B233493.60	White	Window Caulking	None Detected
19-61		B233493.61	White	Window Caulking	None Detected
20-62		B233493.62	White,Tan	Wall Coating	None Detected
20-63		B233493.63	White,Tan	Wall Coating	None Detected
20-64		B233493.64	White,Tan	Wall Coating	None Detected
20-65		B233493.65	White,Tan	Wall Coating	None Detected
20-66		B233493.66	White,Tan	Wall Coating	None Detected
20-67		B233493.67	White,Tan	Wall Coating	None Detected
20-68		B233493.68	White	Wall Coating	None Detected
21-69		B233493.69	White	Floor Leveler	None Detected
21-70		B233493.70	White	Floor Leveler	None Detected
21-71		B233493.71	White	Floor Leveler	None Detected
22-72		B233493.72A	Tan	4" Covebase	None Detected
	Layer 1	B233493.72B	Cream	Mastic (Type 1)	None Detected
	Layer 2	B233493.72B	Brown	Mastic (Type 2)	None Detected
22-73		B233493.73A	Tan	4" Covebase	None Detected
	Layer 1	B233493.73B	Cream	Mastic (Type 1)	None Detected
	Layer 2	B233493.73B	Brown	Mastic (Type 2)	None Detected
22-74		B233493.74A	Tan	4" Covebase	None Detected
	Layer 1	B233493.74B	Cream	Mastic (Type 1)	None Detected
	Layer 2	B233493.74B	Brown	Mastic (Type 2)	None Detected
23-75		B233493.75	Gray	Door Caulking	None Detected
23-76		B233493.76	Gray	Door Caulking	None Detected
23-77		B233493.77	Gray	Door Caulking	None Detected
24-78		B233493.78	White	Window Glazing	None Detected
24-79		B233493.79	White	Window Glazing	None Detected
24-80		B233493.80	White	Window Glazing	None Detected
25-81	Layer 1	B233493.81	White	Window Caulking (Type 1)	None Detected
	Layer 2	B233493.81	Gray	Window Caulking (Type 2)	None Detected
25-82	Layer 1	B233493.82	White	Window Caulking (Type 1)	None Detected
	Layer 2	B233493.82	Gray	Window Caulking (Type 2)	None Detected

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Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Building 120 Dayton VAMC, N1227410 **LAB CODE: B233493v2**

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
25-83	Layer 1	B233493.83	White	Window Caulking (Type 1)	None Detected
	Layer 2	B233493.83	Gray	Window Caulking (Type 2)	None Detected
26-84		B233493.84	White	Window Caulking	None Detected
26-85		B233493.85	White	Window Caulking	None Detected
26-86		B233493.86	White	Window Caulking	None Detected

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ASBESTOS BULK ANALYSIS

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Client: Terracon Consultants, Inc.
611 Lunken Park Drive
Cincinnati, OH 45226

Lab Code: B233493v2
Date Received: 02-14-23
Date Analyzed: 02-14-23
Date Reported: 02-14-23

Project: Building 120 Dayton VAMC, N1227410

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
01-01 B233493.01	Plaster	Heterogeneous Tan Non-fibrous Bound	<1%	Hair	65% 35%	Silicates Binder	None Detected
01-02 Layer 1 B233493.02	Plaster Skim Coat	Heterogeneous White Non-fibrous Bound			60% 35% 5%	Binder Silicates Paint	None Detected
Layer 2 B233493.02	Plaster Base Coat	Heterogeneous Tan Non-fibrous Bound	<1%	Hair	65% 35%	Silicates Binder	None Detected
01-03 Layer 1 B233493.03	Plaster Skim Coat	Heterogeneous White Non-fibrous Bound			60% 35% 5%	Binder Silicates Paint	None Detected
Layer 2 B233493.03	Plaster Base Coat	Heterogeneous Tan Non-fibrous Bound	<1%	Hair	65% 35%	Silicates Binder	None Detected
01-04 Layer 1 B233493.04	Plaster Skim Coat	Heterogeneous White Non-fibrous Bound			60% 35% 5%	Binder Silicates Paint	None Detected
Layer 2 B233493.04	Plaster Base Coat	Heterogeneous Tan Non-fibrous Bound	<1%	Hair	65% 35%	Silicates Binder	None Detected

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ASBESTOS BULK PLM, EPA 600 METHOD

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01-05 Layer 1 B233493.05	Plaster Skim Coat	Heterogeneous White Non-fibrous Bound			60% 35% 5%	Binder Silicates Paint	None Detected
Layer 2 B233493.05	Plaster Base Coat	Heterogeneous Tan Non-fibrous Bound	<1%	Hair	65% 35%	Silicates Binder	None Detected
01-06 Layer 1 B233493.06	Plaster Skim Coat	Heterogeneous White Non-fibrous Bound			60% 35% 5%	Binder Silicates Paint	None Detected
Layer 2 B233493.06	Plaster Base Coat	Heterogeneous Tan Non-fibrous Bound	<1%	Hair	65% 35%	Silicates Binder	None Detected
01-07 Layer 1 B233493.07	Plaster Skim Coat	Heterogeneous White Non-fibrous Bound			60% 35% 5%	Binder Silicates Paint	None Detected
Layer 2 B233493.07	Plaster Base Coat	Heterogeneous Tan Non-fibrous Bound	<1%	Hair	65% 35%	Silicates Binder	None Detected
02-08 B233493.08	Carpet Mastic	Heterogeneous Yellow,Black Non-fibrous Bound	5% <1%	Cellulose Synthetic Fiber	70% 25%	Mastic Tar	None Detected

Unable to separate yellow and black mastics for individual analysis.

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ASBESTOS BULK PLM, EPA 600 METHOD

Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
02-09 B233493.09	Carpet Mastic	Heterogeneous Yellow,Black Non-fibrous Bound	5% <1%	Cellulose Synthetic Fiber	70% 25%	Mastic Tar	None Detected
Unable to separate yellow and black mastics for individual analysis.							
02-10 B233493.10	Carpet Mastic	Heterogeneous Yellow,Black Non-fibrous Bound	5% <1%	Cellulose Synthetic Fiber	70% 25%	Mastic Tar	None Detected
Unable to separate yellow and black mastics for individual analysis.							
03-11 Layer 1 B233493.11A	Mastic	Homogeneous Yellow Non-fibrous Bound	<1%	Synthetic Fiber	90% 10%	Mastic Binder	None Detected
Layer 2 B233493.11A	9"x9" Floor Tile	Homogeneous Brown Non-fibrous Bound			93%	Vinyl	7% Chrysotile
B233493.11B	Mastic	Homogeneous Black Non-fibrous Bound			100%	Tar	None Detected
03-12 B233493.12A	9"x9" Floor Tile	Homogeneous Brown Non-fibrous Bound			93%	Vinyl	7% Chrysotile
B233493.12B	Mastic	Homogeneous Black Non-fibrous Bound			100%	Tar	None Detected

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Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous	Non-Fibrous	ASBESTOS %
03-13 B233493.13A	9"x9" Floor Tile	Homogeneous Brown Non-fibrous Bound	93%	Vinyl	7% Chrysotile
B233493.13B	Mastic	Homogeneous Black Non-fibrous Bound	100%	Tar	None Detected
04-14 B233493.14A	12"x12" Floor Tile (Type 1)	Homogeneous White,Gray Non-fibrous Bound	100%	Vinyl	None Detected
B233493.14B	Mastic	Homogeneous Yellow Non-fibrous Bound	100%	Mastic	None Detected
B233493.14C	12"x12" Floor Tile (Type 2)	Homogeneous White Non-fibrous Bound	95%	Vinyl	5% Chrysotile
B233493.14D	Mastic	Homogeneous Black Non-fibrous Bound	100%	Tar	None Detected
04-15 B233493.15A	12"x12" Floor Tile (Type 1)	Homogeneous White,Gray Non-fibrous Bound	100%	Vinyl	None Detected

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B233493.15B	Mastic	Homogeneous Yellow Non-fibrous Bound		100% Mastic	None Detected
B233493.15C	12"x12" Floor Tile (Type 2)	Homogeneous White Non-fibrous Bound		95% Vinyl	5% Chrysotile
B233493.15D	Mastic	Homogeneous Black Non-fibrous Bound		100% Tar	None Detected
04-16 B233493.16A	12"x12" Floor Tile (Type 1)	Homogeneous White,Gray Non-fibrous Bound		100% Vinyl	None Detected
B233493.16B	Mastic	Homogeneous Yellow Non-fibrous Bound		100% Mastic	None Detected
B233493.16C	12"x12" Floor Tile (Type 2)	Homogeneous White Non-fibrous Bound		95% Vinyl	5% Chrysotile
B233493.16D	Mastic	Homogeneous Black Non-fibrous Bound		100% Tar	None Detected

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Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
05-17 B233493.17	Pipe Encapsulant	Homogeneous White,Yellow Fibrous Loosely Bound	80%	Fiberglass	20%	Binder	None Detected
05-18 B233493.18	Pipe Encapsulant	Homogeneous White,Yellow Fibrous Loosely Bound	80%	Fiberglass	20%	Binder	None Detected
05-19 B233493.19	Pipe Encapsulant	Homogeneous White,Yellow Fibrous Loosely Bound	80%	Fiberglass	20%	Binder	None Detected
06-20* Layer 1 B233493.20	Ceramic Tile	Heterogeneous Tan,Brown Non-fibrous Tightly Bound			60% 40%	Binder Silicates	None Detected
Layer 2 B233493.20	Mortar	Heterogeneous Off-white Non-fibrous Bound			70% 30%	Binder Silicates	None Detected
Layer 3 B233493.20	Grout	Heterogeneous Tan Non-fibrous Tightly Bound			60% 40%	Binder Silicates	None Detected
06-21* Layer 1 B233493.21	Ceramic Tile	Heterogeneous Tan,Brown Non-fibrous Tightly Bound			60% 40%	Binder Silicates	None Detected

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ASBESTOS BULK PLM, EPA 600 METHOD

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Layer 2 B233493.21	Mortar	Heterogeneous Off-white Non-fibrous Bound		70% 30%	Binder Silicates	None Detected
Layer 3 B233493.21	Grout	Heterogeneous Tan Non-fibrous Tightly Bound		60% 40%	Binder Silicates	None Detected
06-22* Layer 1 B233493.22	Ceramic Tile	Heterogeneous Tan,Brown Non-fibrous Tightly Bound		60% 40%	Binder Silicates	None Detected
Layer 2 B233493.22	Mortar	Heterogeneous Off-white Non-fibrous Bound		70% 30%	Binder Silicates	None Detected
Layer 3 B233493.22	Grout	Heterogeneous Tan Non-fibrous Tightly Bound		60% 40%	Binder Silicates	None Detected
07-23 Layer 1 B233493.23	Ceramic Tile	Homogeneous White,Black Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected
Layer 2 B233493.23	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected

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Layer 3 B233493.23	Grout	Homogeneous Black Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
07-24 Layer 1 B233493.24	Ceramic Tile	Homogeneous White,Black Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected
Layer 2 B233493.24	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
Layer 3 B233493.24	Grout	Homogeneous Black Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
07-25 Layer 1 B233493.25	Ceramic Tile	Homogeneous White,Black Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected
Layer 2 B233493.25	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
Layer 3 B233493.25	Grout	Homogeneous Black Non-fibrous Bound		65% 35%	Silicates Binder	None Detected

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ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous	Non-Fibrous		ASBESTOS %
08-26 Layer 1 B233493.26	Ceramic Tile	Homogeneous White Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected
Layer 2 B233493.26	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
Layer 3 B233493.26	Grout	Homogeneous White Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
08-27 Layer 1 B233493.27	Ceramic Tile	Homogeneous White Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected
Layer 2 B233493.27	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
Layer 3 B233493.27	Grout	Homogeneous White Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
08-28 Layer 1 B233493.28	Ceramic Tile	Homogeneous White Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected

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ASBESTOS BULK PLM, EPA 600 METHOD

Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous	Non-Fibrous		ASBESTOS %
Layer 2 B233493.28	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
Layer 3 B233493.28	Grout	Homogeneous White Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
09-29 Layer 1 B233493.29	Ceramic Tile	Homogeneous Brown Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected
Layer 2 B233493.29	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
Layer 3 B233493.29	Grout	Homogeneous Brown Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
09-30 B233493.30	Grout	Homogeneous Brown Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
No ceramic tile or mortar present in sample bag.						
09-31 Layer 1 B233493.31	Ceramic Tile	Homogeneous Brown Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected

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Layer 2 B233493.31	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
Layer 3 B233493.31	Grout	Homogeneous Brown Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
10-32 Layer 1 B233493.32	Ceramic Tile	Homogeneous Brown Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected
Layer 2 B233493.32	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
Layer 3 B233493.32	Grout	Homogeneous Brown Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
10-33 Layer 1 B233493.33	Ceramic Tile	Homogeneous Brown Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected
Layer 2 B233493.33	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected

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Layer 3 B233493.33	Grout	Homogeneous Brown Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
10-34 Layer 1 B233493.34	Ceramic Tile	Homogeneous Brown Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected
Layer 2 B233493.34	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
Layer 3 B233493.34	Grout	Homogeneous Brown Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
11-35 B233493.35	Door Caulking	Heterogeneous Tan Non-fibrous Bound		95% 5%	Caulk Paint	<1% Chrysotile
11-36 B233493.36	Door Caulking	Heterogeneous Tan Non-fibrous Bound		95% 5%	Caulk Paint	<1% Chrysotile
11-37 B233493.37	Door Caulking	Heterogeneous Tan Non-fibrous Bound		95% 5%	Caulk Paint	<1% Chrysotile

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12-38 B233493.38	Door Caulking	Homogeneous White Non-fibrous Bound			100%	Caulk	None Detected
12-39 B233493.39	Door Caulking	Homogeneous White Non-fibrous Bound			100%	Caulk	None Detected
12-40 B233493.40	Door Caulking	Homogeneous White Non-fibrous Bound			100%	Caulk	None Detected
13-41 B233493.41A	Stair Tread	Homogeneous Black Non-fibrous Tightly Bound			100%	Rubber	None Detected
B233493.41B	Mastic	Homogeneous Black Non-fibrous Bound	<1%	Cellulose	100%	Mastic	None Detected
13-42 B233493.42A	Stair Tread	Homogeneous Black Non-fibrous Tightly Bound			100%	Rubber	None Detected
B233493.42B	Mastic	Homogeneous Black Non-fibrous Bound	<1%	Cellulose	100%	Mastic	None Detected

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13-43 B233493.43A	Stair Tread	Homogeneous Black Non-fibrous Tightly Bound			100%	Rubber	None Detected
B233493.43B	Mastic	Homogeneous Black Non-fibrous Bound	<1%	Cellulose	100%	Mastic	None Detected
14-44 B233493.44A	9"x9" Floor Tile	Homogeneous Brown Non-fibrous Tightly Bound			93%	Vinyl	7% Chrysotile
Layer 1 B233493.44B	Mastic	Homogeneous Black Non-fibrous Bound			95% 5%	Tar Silicates	None Detected
Layer 2 B233493.44B	Floor Leveler	Homogeneous Brown Non-fibrous Bound			60% 40%	Binder Silicates	None Detected
14-45 B233493.45A	9"x9" Floor Tile	Homogeneous Brown Non-fibrous Tightly Bound			93%	Vinyl	7% Chrysotile
Layer 1 B233493.45B	Mastic	Homogeneous Black Non-fibrous Bound			95% 5%	Tar Silicates	None Detected

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Layer 2 B233493.45B	Floor Leveler	Homogeneous Brown Non-fibrous Bound		60% 40%	Binder Silicates	None Detected
14-46 B233493.46A	9"x9" Floor Tile	Homogeneous Brown Non-fibrous Tightly Bound		93%	Vinyl	7% Chrysotile
Layer 1 B233493.46B	Mastic	Homogeneous Black Non-fibrous Bound		95% 5%	Tar Silicates	None Detected
Layer 2 B233493.46B	Floor Leveler	Homogeneous Brown Non-fibrous Bound		60% 40%	Binder Silicates	None Detected
15-47 Layer 1 B233493.47	Ceramic Tile	Homogeneous Red Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected
Layer 2 B233493.47	Mortar	Homogeneous Gray Non-fibrous Bound		65% 35%	Silicates Binder	None Detected
15-48 Layer 1 B233493.48	Ceramic Tile	Homogeneous Red Non-fibrous Tightly Bound		70% 30%	Silicates Binder	None Detected

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Layer 2 B233493.48	Mortar	Homogeneous Gray Non-fibrous Bound			65% 35%	Silicates Binder	None Detected
15-49 Layer 1 B233493.49	Ceramic Tile	Homogeneous Red Non-fibrous Tightly Bound			70% 30%	Silicates Binder	None Detected
Layer 2 B233493.49	Mortar	Homogeneous Gray Non-fibrous Bound			65% 35%	Silicates Binder	None Detected
16-50 B233493.50	Insulation Debris	Heterogeneous Black Non-fibrous Loose	10% 5%	Cellulose Fiberglass	80% 5%	Binder Non-Fibrous Debris	None Detected
16-51 B233493.51	Insulation Debris	Heterogeneous Black Non-fibrous Loose	10% 5%	Cellulose Fiberglass	80% 5%	Binder Non-Fibrous Debris	None Detected
16-52 B233493.52	Insulation Debris	Heterogeneous Black Non-fibrous Loose	10% 5%	Cellulose Fiberglass	80% 5%	Binder Non-Fibrous Debris	None Detected
17-53 Layer 1 B233493.53	Asphalt Shingle	Heterogeneous Gray,Black Fibrous Bound	50%	Fiberglass	40% 10%	Tar Gravel	None Detected

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ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Terracon Consultants, Inc.
611 Lunken Park Drive
Cincinnati, OH 45226

Lab Code: B233493v2
Date Received: 02-14-23
Date Analyzed: 02-14-23
Date Reported: 02-14-23

Project: Building 120 Dayton VAMC, N1227410

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
Layer 2 B233493.53	Tarpaper	Homogeneous Black Fibrous Bound	70%	Cellulose	30%	Tar	None Detected
17-54 Layer 1 B233493.54	Asphalt Shingle	Heterogeneous Gray,Black Fibrous Bound	50%	Fiberglass	40% 10%	Tar Gravel	None Detected
Layer 2 B233493.54	Tarpaper	Homogeneous Black Fibrous Bound	70%	Cellulose	30%	Tar	None Detected
17-55 Layer 1 B233493.55	Asphalt Shingle	Heterogeneous Gray,Black Fibrous Bound	50%	Fiberglass	40% 10%	Tar Gravel	None Detected
Layer 2 B233493.55	Tarpaper	Homogeneous Black Fibrous Bound	70%	Cellulose	30%	Tar	None Detected
18-56 B233493.56A	12"x12" Floor Tile	Homogeneous White,Gray Non-fibrous Tightly Bound			100%	Vinyl	None Detected
B233493.56B	Mastic	Homogeneous Black Non-fibrous Bound			100%	Tar	None Detected

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ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Terracon Consultants, Inc.
611 Lunken Park Drive
Cincinnati, OH 45226

Lab Code: B233493v2
Date Received: 02-14-23
Date Analyzed: 02-14-23
Date Reported: 02-14-23

Project: Building 120 Dayton VAMC, N1227410

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous	Non-Fibrous	ASBESTOS %
18-57 B233493.57A	12"x12" Floor Tile	Homogeneous White,Gray Non-fibrous Tightly Bound		100% Vinyl	None Detected
B233493.57B	Mastic	Homogeneous Black Non-fibrous Bound		100% Tar	None Detected
18-58 B233493.58A	12"x12" Floor Tile	Homogeneous White,Gray Non-fibrous Tightly Bound		100% Vinyl	None Detected
B233493.58B	Mastic	Homogeneous Black Non-fibrous Bound		100% Tar	None Detected
19-59 B233493.59	Window Caulking	Homogeneous White Non-fibrous Bound		100% Caulk	None Detected
19-60 B233493.60	Window Caulking	Homogeneous White Non-fibrous Bound		100% Caulk	None Detected
19-61 B233493.61	Window Caulking	Homogeneous White Non-fibrous Bound		100% Caulk	None Detected

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ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Terracon Consultants, Inc.
611 Lunken Park Drive
Cincinnati, OH 45226

Lab Code: B233493v2
Date Received: 02-14-23
Date Analyzed: 02-14-23
Date Reported: 02-14-23

Project: Building 120 Dayton VAMC, N1227410

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous	Non-Fibrous		ASBESTOS %
20-62 B233493.62	Wall Coating	Heterogeneous White,Tan Non-fibrous Bound		65% 35% <1%	Silicates Binder Paint	None Detected
20-63 B233493.63	Wall Coating	Heterogeneous White,Tan Non-fibrous Bound		65% 35% <1%	Silicates Binder Paint	None Detected
20-64 B233493.64	Wall Coating	Heterogeneous White,Tan Non-fibrous Bound		65% 35% <1%	Silicates Binder Paint	None Detected
20-65 B233493.65	Wall Coating	Heterogeneous White,Tan Non-fibrous Bound		65% 35% <1%	Silicates Binder Paint	None Detected
20-66 B233493.66	Wall Coating	Heterogeneous White,Tan Non-fibrous Bound		65% 35% <1%	Silicates Binder Paint	None Detected
20-67 B233493.67	Wall Coating	Heterogeneous White,Tan Non-fibrous Bound		65% 35% <1%	Silicates Binder Paint	None Detected
20-68 B233493.68	Wall Coating	Homogeneous White Non-fibrous Bound		65% 35%	Silicates Binder	None Detected

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ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Terracon Consultants, Inc.
611 Lunken Park Drive
Cincinnati, OH 45226

Lab Code: B233493v2
Date Received: 02-14-23
Date Analyzed: 02-14-23
Date Reported: 02-14-23

Project: Building 120 Dayton VAMC, N1227410

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous	Non-Fibrous		ASBESTOS %
21-69 B233493.69	Floor Leveler	Homogeneous White Non-fibrous Bound		65% 35%	Binder Silicates	None Detected
21-70 B233493.70	Floor Leveler	Homogeneous White Non-fibrous Bound		65% 35%	Binder Silicates	None Detected
21-71 B233493.71	Floor Leveler	Homogeneous White Non-fibrous Bound		65% 35%	Binder Silicates	None Detected
22-72 B233493.72A	4" Covebase	Homogeneous Tan Non-fibrous Tightly Bound		100%	Vinyl	None Detected
Layer 1 B233493.72B	Mastic (Type 1)	Homogeneous Cream Non-fibrous Bound		100%	Mastic	None Detected
Layer 2 B233493.72B	Mastic (Type 2)	Homogeneous Brown Non-fibrous Bound		100%	Mastic	None Detected
22-73 B233493.73A	4" Covebase	Homogeneous Tan Non-fibrous Tightly Bound		100%	Vinyl	None Detected

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ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Terracon Consultants, Inc.
611 Lunken Park Drive
Cincinnati, OH 45226

Lab Code: B233493v2
Date Received: 02-14-23
Date Analyzed: 02-14-23
Date Reported: 02-14-23

Project: Building 120 Dayton VAMC, N1227410

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous	Non-Fibrous	ASBESTOS %
Layer 1 B233493.73B	Mastic (Type 1)	Homogeneous Cream Non-fibrous Bound		100% Mastic	None Detected
Layer 2 B233493.73B	Mastic (Type 2)	Homogeneous Brown Non-fibrous Bound		100% Mastic	None Detected
22-74 B233493.74A	4" Covebase	Homogeneous Tan Non-fibrous Tightly Bound		100% Vinyl	None Detected
Layer 1 B233493.74B	Mastic (Type 1)	Homogeneous Cream Non-fibrous Bound		100% Mastic	None Detected
Layer 2 B233493.74B	Mastic (Type 2)	Homogeneous Brown Non-fibrous Bound		100% Mastic	None Detected
23-75 B233493.75	Door Caulking	Heterogeneous Gray Non-fibrous Bound		95% Caulk 5% Paint	None Detected
23-76 B233493.76	Door Caulking	Heterogeneous Gray Non-fibrous Bound		95% Caulk 5% Paint	None Detected

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ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Terracon Consultants, Inc.
611 Lunken Park Drive
Cincinnati, OH 45226

Lab Code: B233493v2
Date Received: 02-14-23
Date Analyzed: 02-14-23
Date Reported: 02-14-23

Project: Building 120 Dayton VAMC, N1227410

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous	Non-Fibrous		ASBESTOS %
23-77 B233493.77	Door Caulking	Heterogeneous Gray Non-fibrous Bound		95% 5%	Caulk Paint	None Detected
24-78 B233493.78	Window Glazing	Heterogeneous White Non-fibrous Bound		80% 15% 5%	Binder Calc Carb Paint	None Detected
24-79 B233493.79	Window Glazing	Heterogeneous White Non-fibrous Bound		80% 15% 5%	Binder Calc Carb Paint	None Detected
24-80 B233493.80	Window Glazing	Heterogeneous White Non-fibrous Bound		80% 15% 5%	Binder Calc Carb Paint	None Detected
25-81 Layer 1 B233493.81	Window Caulking (Type 1)	Heterogeneous White Non-fibrous Bound		95% 5%	Caulk Paint	None Detected
Layer 2 B233493.81	Window Caulking (Type 2)	Heterogeneous Gray Non-fibrous Bound		95% 5%	Caulk Paint	None Detected
25-82 Layer 1 B233493.82	Window Caulking (Type 1)	Heterogeneous White Non-fibrous Bound		95% 5%	Caulk Paint	None Detected

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ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

Client: Terracon Consultants, Inc.
611 Lunken Park Drive
Cincinnati, OH 45226

Lab Code: B233493v2
Date Received: 02-14-23
Date Analyzed: 02-14-23
Date Reported: 02-14-23

Project: Building 120 Dayton VAMC, N1227410

ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous	Non-Fibrous		ASBESTOS %
Layer 2 B233493.82	Window Caulking (Type 2)	Heterogeneous Gray Non-fibrous Bound		95% 5%	Caulk Paint	None Detected
25-83 Layer 1 B233493.83	Window Caulking (Type 1)	Heterogeneous White Non-fibrous Bound		95% 5%	Caulk Paint	None Detected
Layer 2 B233493.83	Window Caulking (Type 2)	Heterogeneous Gray Non-fibrous Bound		95% 5%	Caulk Paint	None Detected
26-84 B233493.84	Window Caulking	Homogeneous White Non-fibrous Bound		100%	Caulk	None Detected
26-85 B233493.85	Window Caulking	Homogeneous White Non-fibrous Bound		100%	Caulk	None Detected
26-86 B233493.86	Window Caulking	Homogeneous White Non-fibrous Bound		100%	Caulk	None Detected

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LEGEND:

Non-Anth	=	Non-Asbestiform Anthophyllite
Non-Trem	=	Non-Asbestiform Tremolite
Calc Carb	=	Calcium Carbonate

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

REPORTING LIMIT: <1% by visual estimation

REPORTING LIMIT FOR POINT COUNTS: 0.25% by 400 Points or 0.1% by 1,000 Points

REGULATORY LIMIT: >1% by weight

Due to the limitations of the EPA 600 method, nonfriable organically bound materials (NOBs) such as vinyl floor tiles can be difficult to analyze via polarized light microscopy (PLM). EPA recommends that all NOBs analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM). Please note that PLM analysis of dust and soil samples for asbestos is not covered under NVLAP accreditation. *Estimated measurement of uncertainty is available on request.*

This report relates only to the samples tested or analyzed and may not be reproduced, except in full, without written approval by Eurofins CEI. Eurofins CEI makes no warranty representation regarding the accuracy of client submitted information in preparing and presenting analytical results. Interpretation of the analytical results is the sole responsibility of the client. Samples were received in acceptable condition unless otherwise noted. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.

Information provided by customer includes customer sample ID and sample description.

ANALYST: _____
Rosalinda Cruz

APPROVED BY: _____
Tianbao Bai, Ph.D., CIH
Laboratory Director

NVLAP® TESTING
NVLAP LAB CODE: 600323-0

A version indicated by 'v' after the Lab ID# with a value greater than 1 indicates an amendment has occurred. The revised sample/description/ID is indicated by an *

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CHAIN OF CUSTODY

3

730 SE Maynard Road, Cary, NC 27511
Tel: 866-481-1412; Fax: 919-481-1442

LAB USE ONLY:
CEI Lab Code: B233493
CEI Lab I.D. Range:

COMPANY INFORMATION	PROJECT INFORMATION
CEI CLIENT #:	Job Contact:
Company: Terracon Consultants	Email / Tel:
Address: 601 Lunkenpark Dr.	Project Name: Building 120 Dayton VAMC
Cincinnati, OH	Project ID#: N1227410
Email: Joshua.Vogel@Terracon.com	PO #: N1227410
Tel: (513) 612-9002 Fax:	STATE SAMPLES COLLECTED IN: OH

IF TAT IS NOT MARKED STANDARD 3 DAY TAT APPLIES.

ASBESTOS	METHOD	TURN AROUND TIME 4 HR	8 HR	1 DAY	2 DAY	3 DAY	5 DAY
PLM BULK	EPA 600	☐	☒	☐	☐	☐	☐
PLM POINT COUNT (400)	EPA 600	☐	☐	☐	☐	☐	☐
PLM POINT COUNT (1000)	EPA 600	☐	☐	☐	☐	☐	☐
PLM GRAV w POINT COUNT	EPA 600		☐	☐	☐	☐	☐
PLM BULK	CARB 435		☐	☐	☐	☐	☐
PCM AIR	NIOSH 7400	☐	☐	☐	☐	☐	☐
TEM AIR	EPA AHERA	☐	☐	☐	☐	☐	☐
TEM AIR	NIOSH 7402	☐	☐	☐	☐	☐	☐
TEM AIR (PCME)	ISO 10312	☐	☐	☐	☐	☐	☐
TEM AIR	ASTM 6281-15	☐	☐	☐	☐	☐	☐
TEM BULK	CHATFIELD		☐	☐	☐	☐	☐
TEM DUST WIPE	ASTM D6480-05 (2010)	☐	☐	☐	☐	☐	☐
TEM DUST MICROVAC	ASTM D5755-09 (2014)	☐	☐	☐	☐	☐	☐
TEM SOIL	ASTM D7521-16			☐	☐	☐	☐
TEM VERMICULITE	CINCINNATI METHOD			☐	☐	☐	☐
TEM QUALITTATIVE	IN-HOUSE METHOD		☐	☐	☐	☐	☐
OTHER:		☐	☐	☐	☐	☐	☐

REMARKS / SPECIAL INSTRUCTIONS:

Samples Number	Material Description
6-20	24x24 Ceramic tile w/ mortar and grout
6-21	
6-22	

☑ Accept Samples
☐ Reject Samples

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	02/13/2023	[signature]	2/14/23 10:40

Samples will be disposed of 30 days after analysis

3174 5890 7941

APPENDIX D

LICENSES AND CERTIFICATIONS

Ohio Environmental Protection Agency

Mike DeWine, Governor
Jon Husted, Lt. Governor
Laurie A. Stevenson, Director

6/8/2022

Lemuel Weyer
Terracon Consultants
611 Lunkenpark Dr
Cincinnati, OH 45226

RE: Evaluation Specialist
Certification Number: ES36337
Expiration Date: 8/3/2023

Dear Lemuel Weyer:

This letter and enclosed certification card approves your request to be certified as an asbestos Evaluation Specialist. You must present your card upon request at any project site while performing duties. Copies of cards are not acceptable as proof of certification.

This certification may be revoked by the Director of the Ohio Environmental Protection Agency (EPA) for violation of any of the requirements of 3745-22 or 3745-20 of the Ohio Administrative Code.

If you have any questions, please contact the Asbestos Program at 614-644-0226 or by email at asbestoslicensing@epa.ohio.gov.

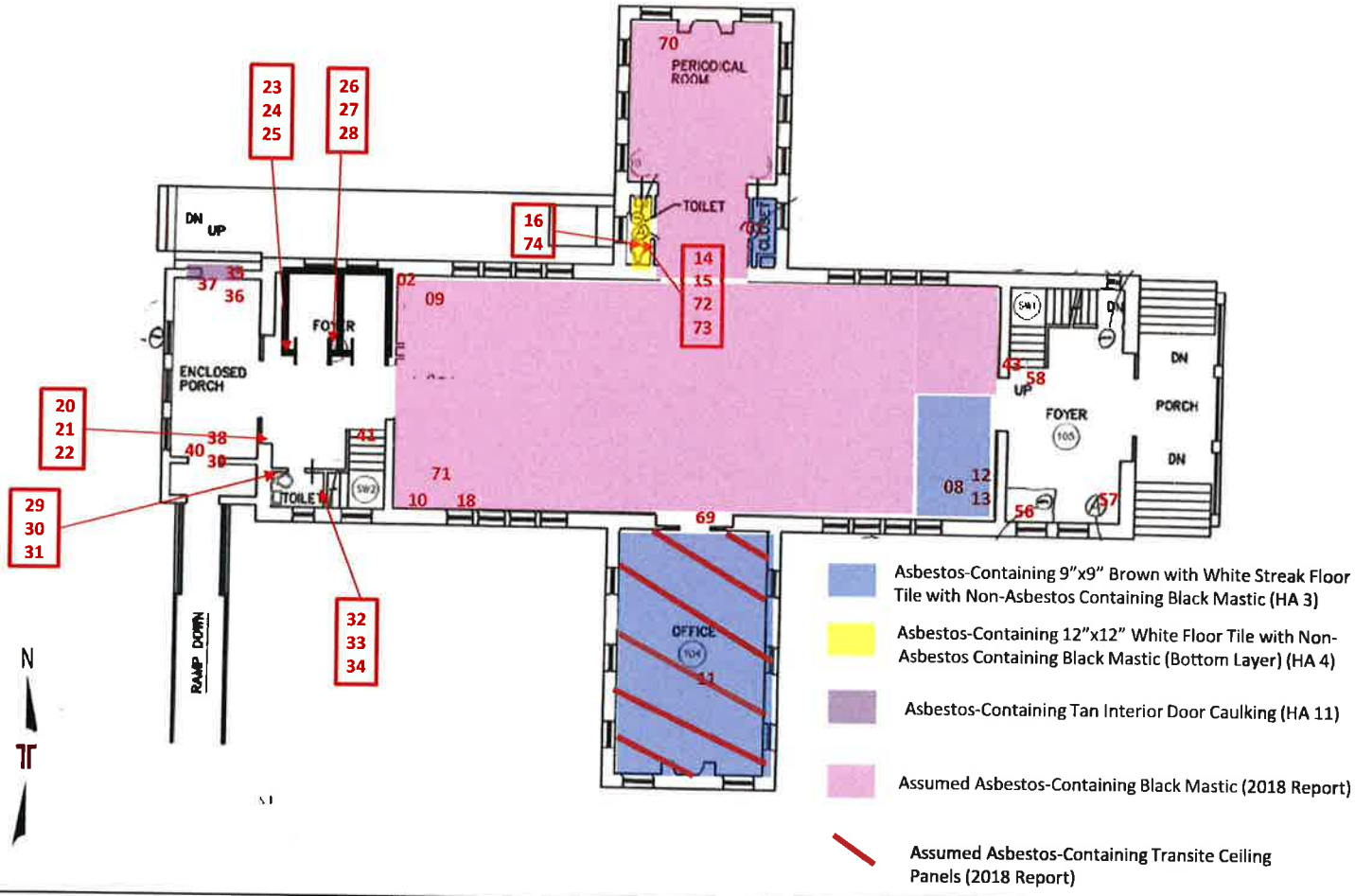
Sincerely,

Joshua S. Koch
Manager, Business Operations Support Section
Ohio EPA - Division of Air Pollution Control

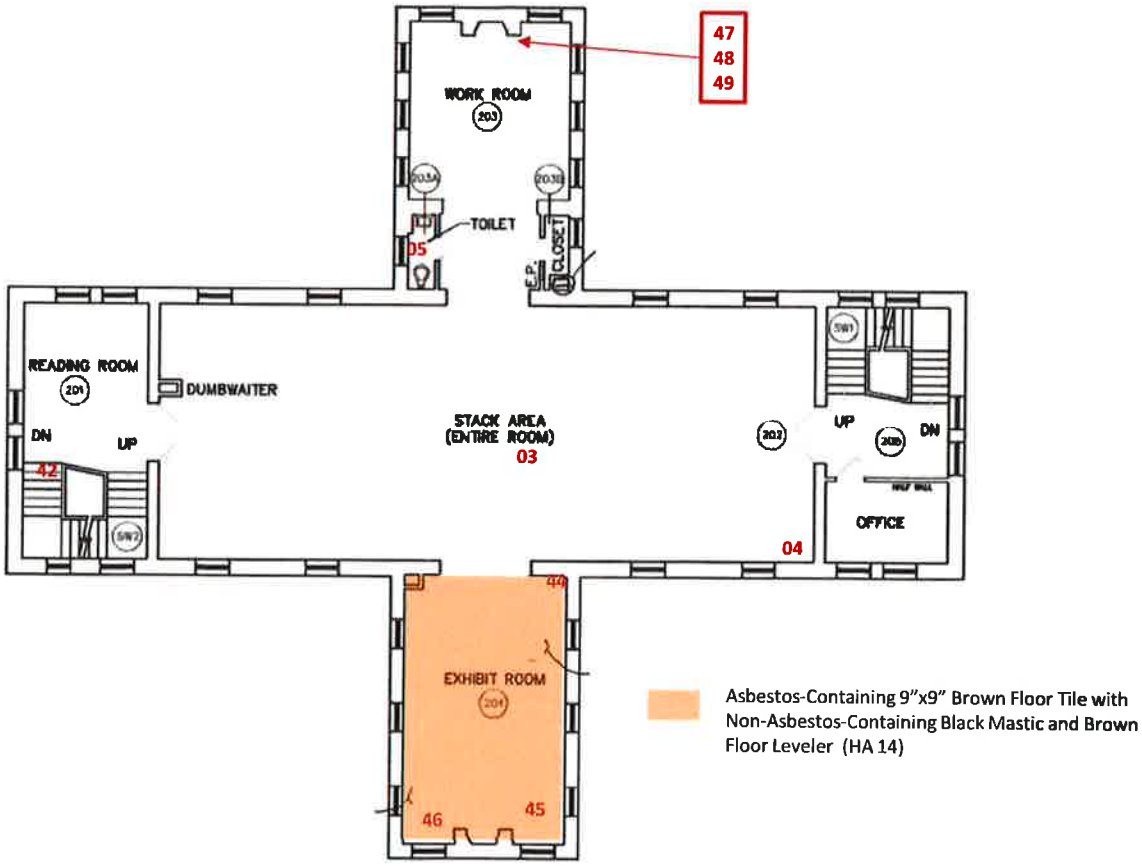
50 West Town Street • Suite 700 • P.O. Box 1049 • Columbus, OH 43216-1049
epa.ohio.gov • (614) 644-3020 • (614) 644-3184 (fax)

APPENDIX E

SAMPLE & ACM LOCATION DRAWINGS

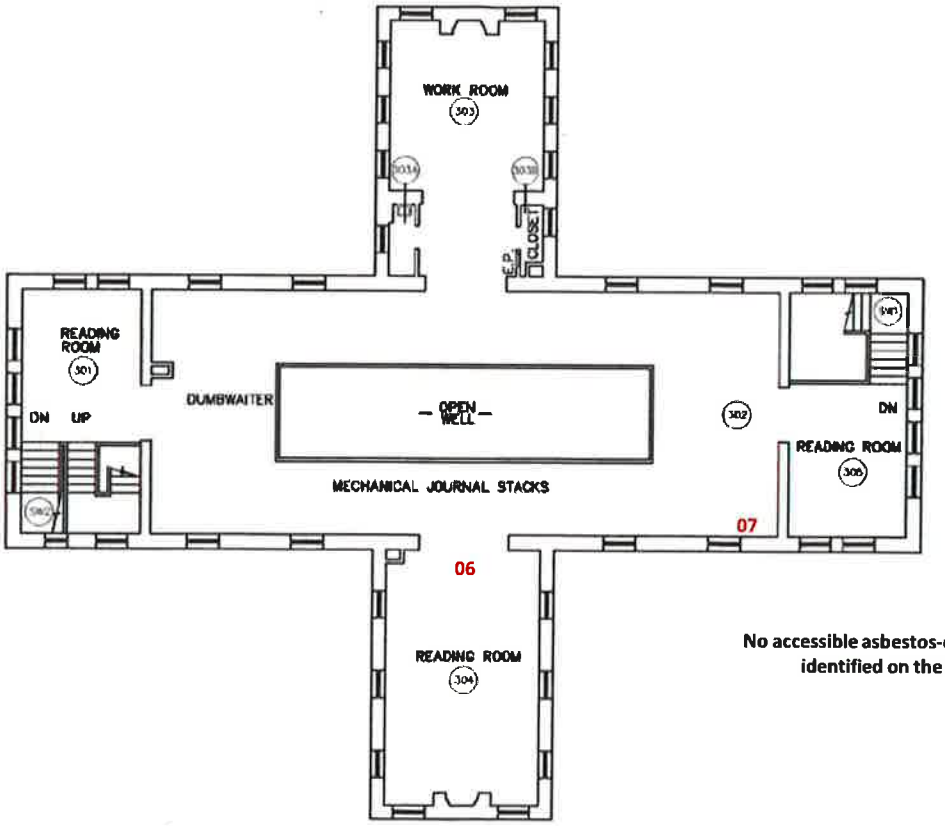


Project No. N1227410	Terracon Consulting Engineers and Scientists 611 Lunken Park Drive Cincinnati, Ohio 45226 PH. (513) 321-05816 FAX (513) 321-0294	1st Floor Sample & ACM Locations	Exhibit
Inspection Date: January 31, 2023		Building 120 Dayton VA Medical Center 4100 W Third St. Dayton, OH 45428	1
Project Manager: Josh Vogel			
APR: Joe Tussey			



N

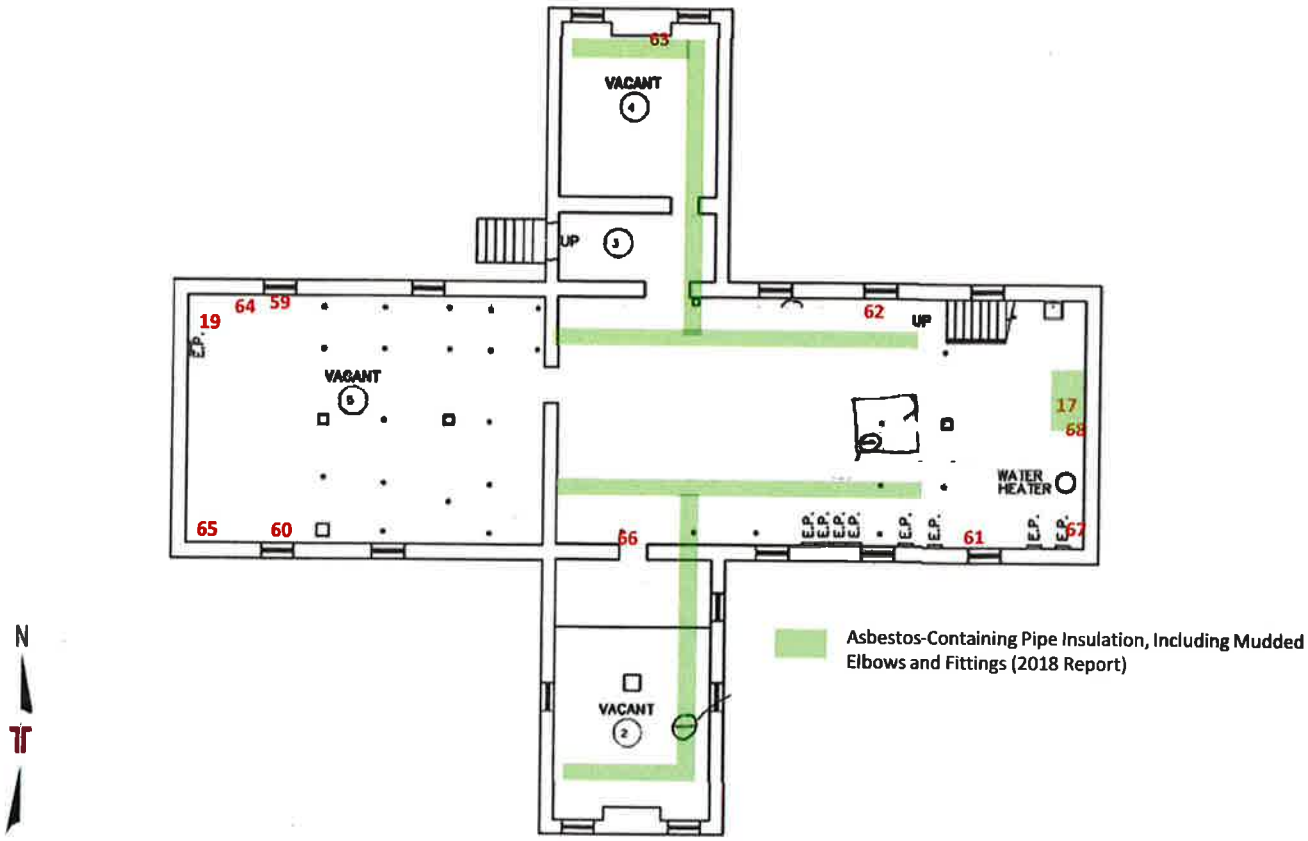
Project No. N1227410	Terracon Consulting Engineers and Scientists 611 Lunken Park Drive Cincinnati, Ohio 45226 PH. (513) 321-05816 FAX (513) 321-0294	2nd Floor Sample & ACM Locations	Exhibit
Inspection Date: January 31, 2023		Building 120 Dayton VA Medical Center 4100 W Third St. Dayton, OH 45428	2
Project Manager: Josh Vogel			
APR: Joe Tussey			



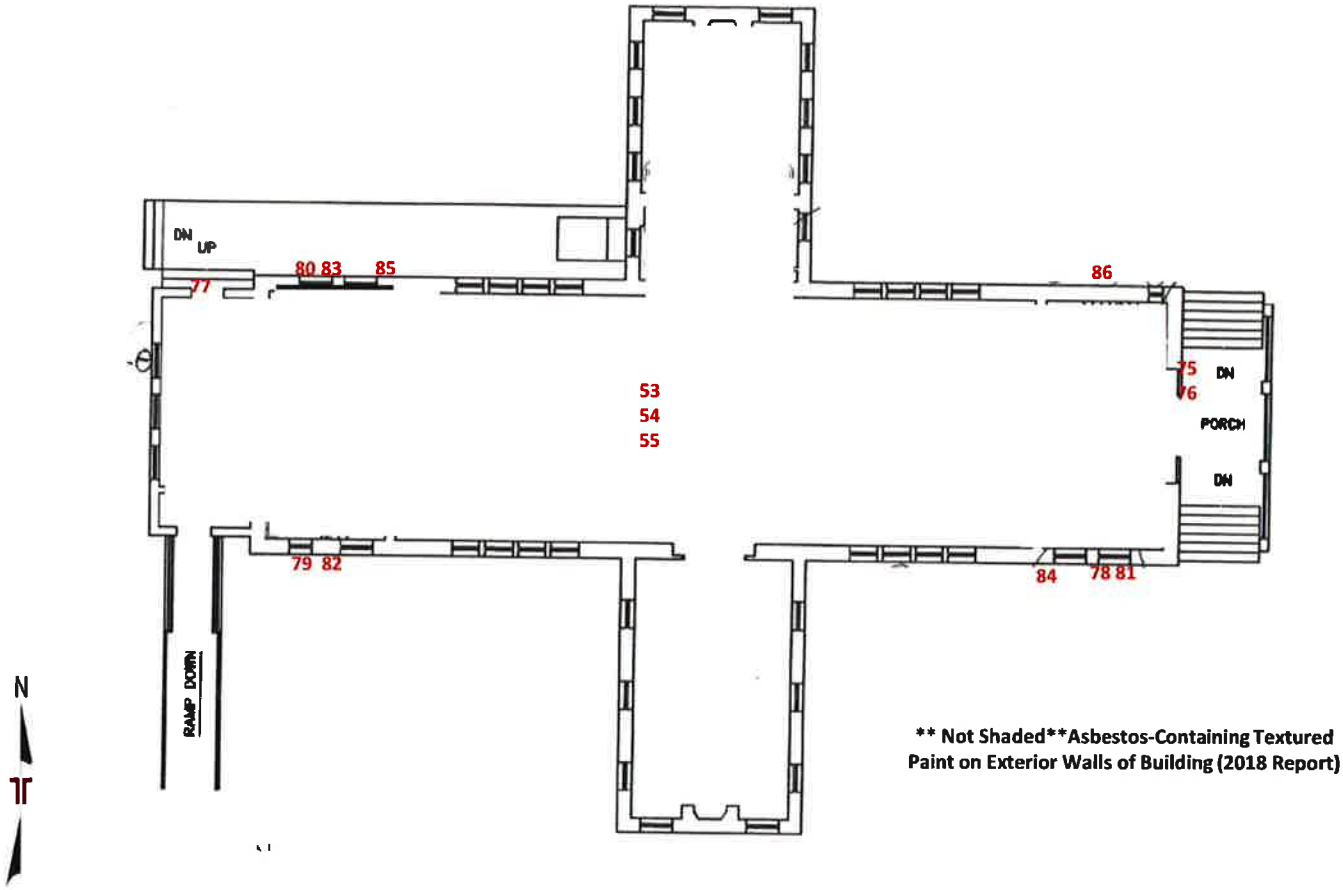
No accessible asbestos-containing materials identified on the 3rd floor area

N

Project No. N1227410	Terracon Consulting Engineers and Scientists 611 Lunken Park Drive Cincinnati, Ohio 45226 PH. (513) 321-05816 FAX (513) 321-0294	3rd Floor Sample & ACM Locations	Exhibit
Inspection Date: January 31, 2023		Building 120 Dayton VA Medical Center 4100 W Third St. Dayton, OH 45428	3
Project Manager: Josh Vogel			
APR: Joe Tussey			



Project No. N1227410	Terracon Consulting Engineers and Scientists 611 Lunken Park Drive Cincinnati, Ohio 45226 PH. (513) 321-05816 FAX (513) 321-0294	**Basement Sample & ACM Locations**	**Exhibit**
Inspection Date: January 31, 2023		Building 120 Dayton VA Medical Center 4100 W Third St. Dayton, OH 45428	**4**
Project Manager: Josh Vogel			
APR: Joe Tussey			



** Not Shaded** Asbestos-Containing Textured Paint on Exterior Walls of Building (2018 Report)

Project No. N1227410	Terracon Consulting Engineers and Scientists 611 Lunken Park Drive Cincinnati, Ohio 45226 PH. (513) 321-05816 FAX (513) 321-0294	**Exterior Sample & ACM Locations**	**Exhibit**
Inspection Date: January 31, 2023		Building 120 Dayton VA Medical Center 4100 W Third St. Dayton, OH 45428	**5**
Project Manager: Josh Vogel			
APR: Joe Tussey			

APPENDIX F

PHOTO LOG

Photo #1- HA 03: Asbestos-Containing 9"x9" Brown with White Streak Floor Tile with Non-Asbestos-Containing Black Mastic

Photo #2- HA 04: Asbestos-Containing 12"x12" White Floor Tile (Bottom Layer) with Non-Asbestos-Containing Black Mastic Beneath Non-Asbestos-Containing 12"x12" White with Gray Steak Floor Tile (Top Layer) and Yellow Mastic

Photo #3- HA 11: <1% Asbestos-Containing Tan Interior Door Caulking

Photo #4- HA 14: Asbestos-Containing 9"x9" Brown Floor Tile with Non-Asbestos-Containing Black Mastic and Brown Floor Leveler

Photo #5: Asbestos-Containing Pipe Insulation Including Mudded Elbows and Fittings	**Photo #6:** Asbestos-Containing Black Mastic on Concrete and/or Wood Floors
No Photo Available	
Photo #7: Asbestos-Containing Cementitious (Transite™) Ceiling Panels	**Photo #8:** Asbestos-Containing Textured Paint

APPENDIX F
Prior Report

Asbestos Re-Assessment

Dayton VA Medical Center
Building 120

November 2018

TABLE OF CONTENTS

1 Executive Summary
2 Introduction
3 Methodology
4 Asbestos Database
5 Picture Log
6 Certifications

Executive Summary

The HGS Engineering, Inc. project lead for this project was Tim Thompson, he served as the Project Manager and Ohio Asbestos Evaluation Specialist and Asbestos Hazard Abatement Specialist.

Building 120 is Three-story building constructed in 1880 that consists of approximately 16,800 Sq. Ft. The building contains a full finished ground floor and two finished levels. Additionally, the building is currently used as a Library-Museum.

On 15 August 2018 Tim Thompson performed an asbestos re-assessment of Building 115 using two earlier reports completed in 2007 and 2012. These reports were used by HGS as the basis for the re-assessment. These reports identified 8 homogeneous materials that were located in 25 areas throughout the building; of those 25 areas 1 of them has been removed, 11 have no asbestos containing materials identified, and 13 homogeneous areas were still in good condition.

HGS Engineering took no samples.

This building shows no asbestos issues that should be considered requiring immediate attention. The floor tiles are in good condition and with normal maintenance should last for an extended amount of time.

Introduction

On 15 August 2018 Tim Thompson, the Project Manager and Ohio Asbestos Evaluation Specialist and Asbestos Hazard Abatement Specialist, performed an asbestos re-assessment of Building 120 using two earlier reports completed in 2007 and 2012.

Building 120 is Three-story building constructed in 1880 that consists of approximately 16,800 Sq. Ft. The building contains a full finished ground floor and two finished levels. Additionally, the building is currently used as a Library-Museum.

HGS Engineering, Inc. re-assessed the asbestos containing building materials in the basement of building 120. The rooms with asbestos containing materials in good condition are 1, 2, 3, and 4. The room that had no asbestos containing materials identified is 5. Exact material descriptions and locations are listed in the Asbestos Excel Database.

On the first floor, all asbestos containing building materials were in good condition. The rooms with asbestos containing materials in good condition are 101, 101A, 102, 103, 103A, 103B, 104, and 105. The rooms that had no asbestos containing materials identified are SW1 and SW2. Exact material descriptions and locations are listed in the Asbestos Excel Database.

On the second floor, all asbestos containing building materials were in good condition or removed. The room with the removed material is 204. The rooms that had no asbestos containing materials identified were 201, 202, 203, 203A-B, 205, SW1, and SW2. Exact material descriptions and locations are listed in the Asbestos Excel Database.

On the outside of building 120, all asbestos containing material was in good condition. The room with asbestos containing material in good condition is SW2. Exact material description and location are listed in the Asbestos Excel Database.

Methodology

The Scope of work required HGS Engineering to "perform an asbestos re-assessment survey that assessed all locations identified in two previous reports. The survey required HGS to locate and then identify all previously identified asbestos containing building material. The survey also re-assessed the condition of any remaining asbestos containing building material. If the ACBM could not be accessed dues to renovation this was noted in the report. If the ACBM had been removed this was also noted in the report. The report includes recommendations for any remaining ACBM to include being included in the facility Asbestos Operations and Maintenance (O&M) Report.

HGS Engineering started this process with an extensive walk through of the facility to try to locate the building material and homogenous areas identified in the previous reports completed in 2007 and 2012 and to make note of current building materials that may not have been tested in previous surveys. HGS received very good information from personnel that had been at this site for many years about when areas were remodeled or replaced.

When and if additional samples needed to be taken HGS used minimally destructive processes. All sampling was performed in as unobtrusive an area as possible. Exterior samples were coordinated with the COR to prevent roof leaks and water intrusion.

HGS selected sampling locations by identifying materials suspected to contain greater than 1 percent asbestos based on observable differences, group the material building-wide, and collect samples using a building-wide random sampling plan.

HGS Engineering collected all samples of suspected ACM in accordance with EPA and OSHA regulations preventing airborne fiber exposure to the surveyor and facility personnel. Samples collected in occupied office spaces were taken in locations that minimize the risk of potential exposure to occupants and visual impact of the resulting sample location. HGS restored any visible sample locations to a condition as close to original as possible. HGS encapsulated all locations to prevent any subsequent release of asbestos fibers after sample collection. HGS marked sample locations, with the exception of conspicuous sample locations within occupied areas. HGS photographed sample locations at the time of sample collection to aid in future identification of sampling location.

Where sampling was required of accessible suspect materials, HGS utilized inconspicuous sample locations and employed methods least destructive to finished surfaces. All destructive samples were approved by the VA prior to performing task. HGS used non-destructive means for collecting samples whenever possible. Areas disturbed or disturbed by sampling were repaired by the contractor. For example, if a floor tile was removed for sampling, that area of the floor was covered with a floor leveling compound. A hole in drywall or insulation for sampling was patched.

The procedure used for sampling was:
Place a plastic drop cloth under all friable material prior to taking the sample. Don appropriate personal protection equipment when necessary.
Thoroughly wet friable materials before removing a sample. Penetrate all layers of material being sampled.
Place the sample in the numbered sample container, seal the container and wipe the outside of the container with a wet wipe.
Clean the sampling tool and wet wipe or HEPA vacuum the plastic drop cloth. Clean and "restore" the area.
Discard any potentially asbestos-contaminated waste which has been generated, as well as any other materials that may have become contaminated, in a labeled asbestos waste bag. Disposal of asbestos-contaminated waste must adhere to all applicable laws and regulations.

Each location from which a sample was taken, and any area in which asbestos or suspect asbestos debris may have fallen, was cleaned using appropriate methods (e.g., wet wiping, HEPA vacuuming) following the collection of the sample. The site from which a bulk sample of thermal system insulation was taken was sprayed with a commercial sealant, caulked, and taped. No attempt was made to restore the surface to its original condition.

Sample locations in mechanical rooms, utility rooms, etc., were labeled with the sample number and date.

All precautions were taken to prevent the exposure of VA personnel, visitors, and other occupants of the building. Any hazardous wastes generated during the inspection will be dealt with in an appropriate fashion according to all relevant federal, state, and local laws, statutes, regulations, and standards.

HGS used a chain of custody record that conform to established EPA and U.S. Department of Transportation procedures and be kept for all samples taken and submitted for each building by the Lead Inspector.

HGS's inspection team photographed representative sample sites of each material sampled to document the appearance of the material and the general condition of the material. Photographs were made of notable exceptions of the general condition of the material. Photographs were labeled to avoid any confusion.

Asbestos Database

Project Name	Building Number	Drawing Number	Room Number	Room Description	Surface Area	Existing Lighting	Existing Controls	Remarks Description	Material Location	NEW Status	NEW Category	Quantity	Old # of Lamps	Material condition	Fixture Function	Condition for Lamp Type			Feasibility for Lamp	Test Assessment Code	Business notes	Remarks	Lamp Type	Watts	NEW Watts	Total # of Lamps	Image	Remarks - Lamp	Remarks Fixture Description
Region 05	1.05	1	101	Lobby/Entrance	Room Lighting	1.00		Fluorescent Ceiling Fixture, 2 Lamp, Lighting Fixture	Photography Department	NEW Status	Fixture	1	Old	Good		High	Low	Medium	High	Old Fixture, not replaced								
Region 05	1.05	Basement	1	Photo Shop/Staff	Photo Production	6.00		High Bay (4 Bulb) Lighting Fixture, Lighting Fixture	Photography Department	NEW Status	Fixture	1	Old	Good	10 - 20	High	Low	Medium	High	Old Fixture, not replaced								
Region 05	1.05	Basement	2	Photo Darkroom	Photo Production	4.00		High Bay (4 Bulb) Lighting Fixture, Lighting Fixture	Photography Department	NEW Status	Fixture	1	Old	Good	10 - 20	High	Low	Medium	High	Old Fixture, not replaced								
Region 05	1.05	Basement	3	Photo Darkroom	Photo Production	4.00		High Bay (4 Bulb) Lighting Fixture, Lighting Fixture	Photography Department	NEW Status	Fixture	1	Old	Good	10 - 20	High	Low	Medium	High	Old Fixture, not replaced								
Region 05	1.05	Basement	4	Photo Darkroom	Photo Production	6.00		High Bay (4 Bulb) Lighting Fixture, Lighting Fixture	Photography Department	NEW Status	Fixture	1	Old	Good	10 - 20	High	Low	Medium	High	Old Fixture, not replaced								
Region 05	1.05	3	3-17	Home Office	Home Office	2.00		2 Lamp Fluorescent Ceiling Fixture, Lighting Fixture	Fire Hall Station #1	NEW Status	Fixture	8	20W	Good	20	High	High	High	High	Old Fixture, not replaced								
Region 05	1.05	3	3-18	Meeting Room	Meeting Room	2.00		2 Lamp Fluorescent Ceiling Fixture, Lighting Fixture	Fire Hall Station #1	NEW Status	Fixture	4	20	Good	20	High	High	High	High	Old Fixture, not replaced								
City Hall	1.05	3	3-23	Town Clerk's Office	Back Office	2.00		Wall Fixture, Fluorescent Ceiling Fixture, Lighting Fixture	Room 3 Entry Region, Ceiling Fixture, Lighting Fixture, Lighting Fixture	Proposed LED	Fixture	2	1.00W	Good	20	High	High	High	High	Old Fixture, not replaced								
Region 05	1.05	3	3-24	North wing, Investment Room	Back Office	2.00		Wall Fixture, Fluorescent Ceiling Fixture, Lighting Fixture	Room 3 Entry Region, Ceiling Fixture, Lighting Fixture, Lighting Fixture	Proposed LED	Fixture	2	1.00	Good	20	High	High	High	High	Old Fixture, not replaced								
Region 05	1.05	3	3-25A	Town Treasurer	Treasurer's office	2.00		Wall 2' 1 Fluorescent Ceiling Fixture, Wall Fixture, Fluorescent ceiling, Lighting Fixture, Lighting Fixture	Room 3 Treasurer Office	2' x 2' Flat Panel Recessed LED	Fixture	4	18	Good	20	High	High	High	High	Old Fixture, not replaced								
Region 05	1.05	3	3-26	Closet	Storage	1.00		Wall 1 Fluorescent Ceiling Fixture, Wall Fixture, Fluorescent ceiling, Lighting Fixture, Lighting Fixture	Room 3 Closet Office	1' x 4' Flat Panel LED	Fixture	1	18	Good		High	High	High	High	Old Fixture, not replaced								
Region 05	1.05	3	3-27	South Wing Office	Storage	1.00		2 Lamp Fluorescent Ceiling Fixture, Lighting Fixture	Room 3 Ceiling Fixture, Lighting Fixture, Lighting Fixture, Lighting Fixture, Lighting Fixture	Proposed LED	Fixture	2	18W	Good		High	High	High	High	Old Fixture, not replaced								
Region 05	1.05	3	3-28	Cold Room	Storage	1.00		Wall 1 Fluorescent Ceiling Fixture, Wall Fixture, Lighting Fixture, Lighting Fixture	Room 3 Fire Hall Station #1 Entry Region, Ceiling Fixture, Lighting Fixture	2' x 2' Flat Panel Recessed LED	Fixture	4	20W	Good	20	High	High	High	High	Old Fixture, not replaced								
Region 05	1.05	Basement	3-29	Fire Hall Station #1	Fire Hall Station #1	15.00		Wall Fluorescent Ceiling Fixture	Fire Hall Station #1	LED	Fixture	10	15.00W	Good	40	High	High	High	High	Old Fixture, not replaced								
Region 05	1.05	1	101	Office Area					No NEW Fixture																				
Region 05	1.05	1	102	Office Area					No NEW Fixture																				
Region 05	1.05	1	103	Office Area					No NEW Fixture																				
Region 05	1.05	1	104	Meeting Room/Staff Lounge					No NEW Fixture																				
Region 05	1.05	1	107	Staff Lounge/Break Area					No NEW Fixture																				
Region 05	1.05	1	107	Office Area					No NEW Fixture																				
Region 05	1.05	1	108	Office Area					No NEW Fixture																				
Region 05	1.05	1	109	Staff Lounge/Break Area					No NEW Fixture																				
Region 05	1.05	1	110	Office Area					No NEW Fixture																				
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Picture Log

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CONDENSATE

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36
HOT WATER
W PRESSURE STEAM
CONDENSATE

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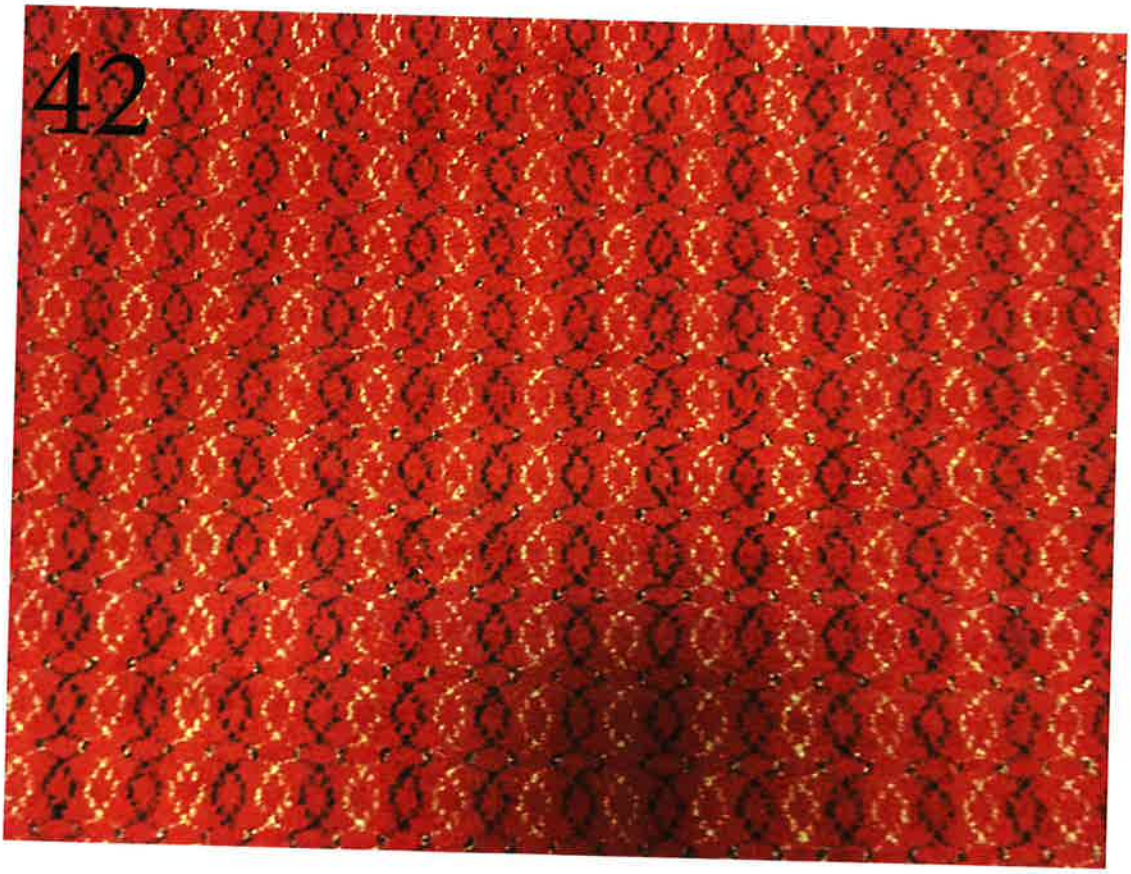
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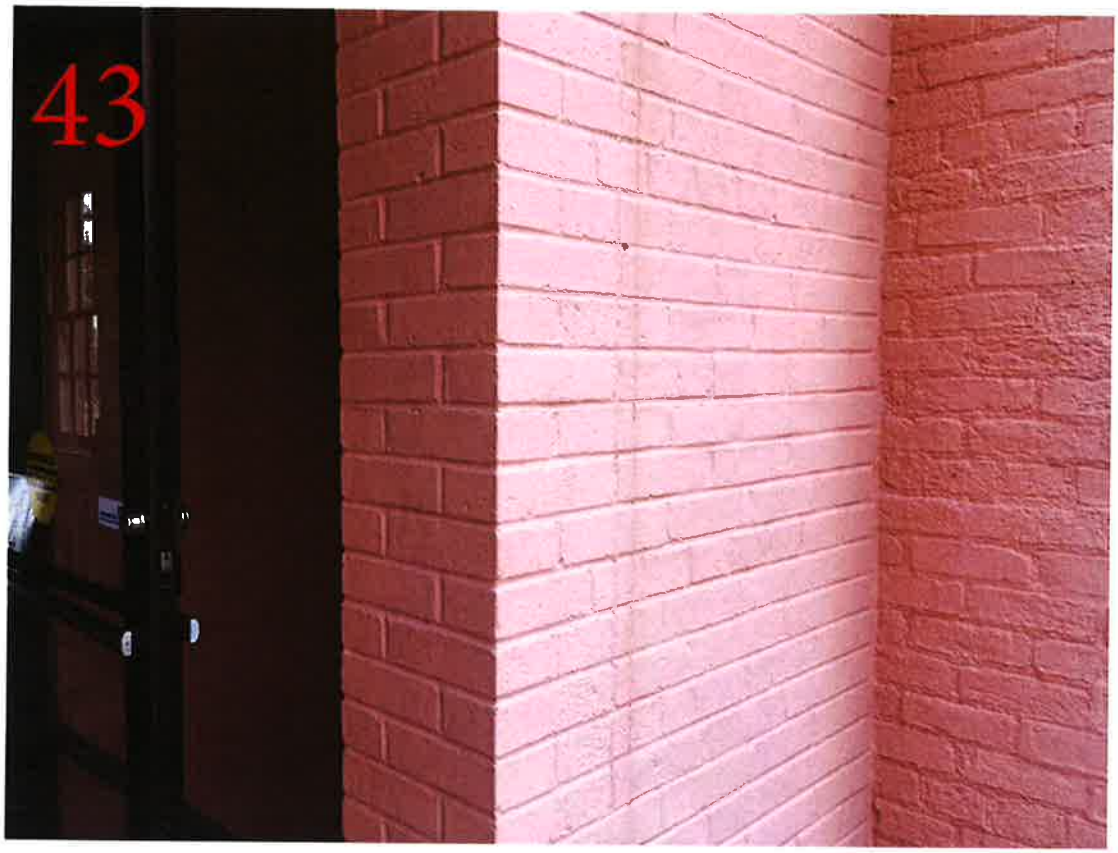
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44

Certifications

State of Ohio
Environmental Protection Agency
Asbestos Program

Asbestos Hazard Evaluation Specialist

Timothy A Thompson

1507 Davis Street SE
Jacksonville AL 37275

DOB: 10/08/1958

Certification Number
ES35939

Expiration Date
09/22/2019

This certification is issued pursuant to Revised Code Chapter 3710 and Administrative Code Chapter 3745-22.

This card is not valid if altered.

State of Ohio
Environmental Protection Agency
Asbestos Program

Asbestos Hazard Abatement Specialist

Timothy A Thompson

1507 Davis St SE
Jacksonville AL 36265

DOB: 10/08/1958

Certification Number
AS31114

Expiration Date
09/09/2019

This certification is issued pursuant to Revised Code Chapter 3710 and Administrative Code Chapter 3745-22.

This card is not valid if altered.

February 17, 2023

Terracon

RDC/John Poe Architects, L.L.L.P.
524 Fernwood Drive
Altamonte Springs, Florida 32701

Attn: Mr. Mike Duke, AIA, LEED AP
Sr. Project Architect
Cell: (800) 362-1523
E: mduke@rdcjpa.com

Re: Limited Paint Sampling for Lead-Content Analysis
VA Project: Stabilize/Improve Building 120
VA Project No.: 552-22-102
Dayton VA Medical Center (DVAMC)
4100 W. Third Street, Dayton, Ohio 45428
Terracon Project No. N1227410

Dear Mr. Duke:

Terracon Consultants, Inc. (Terracon) appreciates the opportunity to submit this letter report to RDC/John Poe Architects, L.L.L.P. (Client) regarding the lead analytical results for limited paint samples collected for the above-referenced project at the Dayton VA Medical Center (DVAMC). The project involves renovation and stabilization impacts to Building 120 at the Dayton VA Medical Center (DVAMC).

On January 31, 2023, Terracon representative Mr. Lem Weyer collected limited paint samples from various prominent painted surfaces regarding Building 120 which appeared to not have been previously sampled as indicated in a provided prior lead paint testing report (i.e., "Lead-Based Paint Inspection Report", Dated November 2018, Prepared by HGS Engineering, Inc. – a copy is attached). Sample collection by Terracon was performed using a clean straight-edge razor to remove paint from designated surfaces. Collected paint samples were placed in sealable containers, labeled with unique sample numbers, and submitted under chain of custody to Eurofins CEI, Inc. of Cary, North Carolina. Paint chip samples were submitted for analysis by Atomic Absorption Spectroscopy (AAS) per EPA Method SW846/3050B/7420M. Eurofins CEI, Inc is accredited for lead in paint analysis by the American Industrial Hygiene Association's (AIHA®) Environmental Lead Laboratory Accreditation Program (ELLAP), accreditation number 103025.

Lead Paint Analytical Results Summary

Terracon collected a total of 14 paint samples for lead-content analysis from various components associated with Building 120 which appeared to not have been previously tested as referenced in the November 2018 Lead-Based Paint Inspection Report (attached). Of the 14 samples collected from various building components, all 14 samples were identified by laboratory analysis

to contain lead above analytical method's reporting limit. A sample and results summary table is included in Attachment 1 (results are presented in percent lead by weight and parts per million {ppm} lead). The laboratory analytical report is included in Attachment 2. A copy of the prior November 2018 Lead-Based Paint Inspection Report is included in Attachment 3.

As a results of Terracon's testing and a review of the prior November 2018 testing report, Terracon recommends treating all painted building components associated with Building 120 as containing lead.

Please note that for the prior testing conducted by HGS Engineering, Inc. (HGS), HGS had utilized a portal, direct-read x-ray fluorescence (XRF) to test for lead in paints. An XRF instrument is proficient at detecting lead in paint at high concentrations but not necessarily at lower concentrations. Therefore, Occupational Safety and Health Administration (OSHA) has determined through issuance of interpretation letters that negative XRF instrument testing results are not acceptable for OSHA regulatory compliance in the absence of laboratory test results. Thus, any results reported as negative or inclusive in HGS's November 2018 report must be assumed to contain lead.

Regulatory Summary

The OSHA Standard, 29 Code of Federal Regulations (CFR) 1926.62 (Lead in Construction), does not reference a specific concentration of lead in a surface coating for applicability of the aforementioned regulation. The requirements under OSHA 29 CFR 1926.62 are applicable to any concentration of detectable lead identified above the analytical method's reporting limit. When disturbed, paints containing lead in any concentration represent an airborne exposure hazard that could exceed the OSHA legally enforceable action level (AL) or permissible exposure limit (PEL). Contractors that bid or conduct work activities that will disturb surfaces with analytically-confirmed lead-containing paint should be made aware of those so that they can plan for proper compliance with applicable federal and state regulations, and applicable VA specifications. Additionally, contractors should be aware that any untested paint surfaces should be assumed to also contain lead unless sampling and analysis refute lead-content.

Closing

The sampling was of a limited nature specific and readily accessible painted surfaces and may not have included every painted surface; additionally, hidden paint layers may be present at varying locations not sampled. The sampling was conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same locale. The results, findings and recommendations expressed in this letter report are based on conditions observed during the sampling event. This letter report has been prepared on behalf of and exclusively for use and reliance by the Client and is not a bidding document. Contractors or consultants reviewing this limited sampling report must draw their own conclusions regarding whether further investigation or remediation is deemed necessary. Terracon does not warrant the work of regulatory agencies, laboratories, or other third-parties supplying information, which may have been used in the preparation of this report. No warranty, express or implied, is made.

Terracon appreciates the opportunity to provide this service to RDC/John Poe L.L.L.P. If you have questions regarding this letter report or if we can be of further service, please contact the undersigned at (513) 321-5816.

Sincerely,
Terracon Consultants, Inc.

Josh Vogel
Group Manager

Joseph Tussey, CHMM
Principal

Attachments: 1) Sample & Results Summary Table
2) Laboratory Analytical Report
3) November 2018 Lead Paint Testing Report

Attachment 1: Sample & Results Summary Table

Terracon Sample #	Component	Paint Color (surface)	Substrate	Sample Location	Results (Lead in % and ppm)
L-1	Ceiling	White	Plaster	Center of 1st Floor	17% or 170,000 ppm
L-2	Wall	White	Plaster	1st Floor: North Storage Closet Wall	26% or 26,000 ppm
L-3	Wall	White	Brick	1st Floor: West Foyer Wall	0.051% or 510 ppm
L-4	Ceiling	White	Plaster	2nd Floor: West End	15% or 150,000 ppm
L-5	Wall	Green	Plaster	2nd Floor: Southwest Corner	18% or 180,000 ppm
L-6	Floor	Brown	Wood	2nd Floor: West End	0.043% or 430 ppm
L-7	Wall	White	Plaster	Top of West Stairwell	26% or 260,000 ppm
L-8	Wall	Green	Plaster	3rd Floor: Southeast Corner	11% or 110,000 ppm
L-9	Ceiling	White	Plaster	3rd Floor: Middle South Side	15% or 150,000 ppm
L-10	White	White	Stone	Bottom of Basement Stairwell	0.0041% or 41 ppm
L-11	Gray	Gray	Ceiling	Bottom of Basement Stairwell	0.22% or 2,200 ppm
L-12	Pink	Pink	Exterior Wall	Middle South Side of Exterior Wall	0.020% or 200 ppm
L-13	Beige	Beige	Exterior Window Frame	Northwest Corner of Exterior Window	0.066% or 660 ppm
L-14	Blue	Blue	Concrete	Front Entrance Step	0.075% or 750 ppm

Attachment 2:

Laboratory Analytical Report

eurofins | CEI
Eurofins CEI
730 SE Maynard Road
Cary, NC 27511
TEL: 866-481-1412
TEL: 919-481-1413
FAX: 919-481-1442

LABORATORY REPORT
LEAD IN PAINT

Client: **Terracon Consultants, Inc.**
611 Lunken Park Drive
Cincinnati, OH 45226

Lab Code: C230133
Received: 02-10-23
Analyzed: 02-14-23
Reported: 02-16-23

Project: DVAMC - Blg 120, N1227410

METHOD: EPA SW846 7000B

CLIENT ID	LAB ID	PPM (µg/g)	CONCENTRATION % BY WEIGHT
L-01	CA459	170000	**17**
Sample contains substrate, potentially affecting results			
L-02	CA460	260000	**26**
L-03	CA461	510	**0.051**
L-04	CA462	150000	**15**
L-05	CA463	180000	**18**
L-06	CA464	430	**0.043**
L-07	CA465	260000	**26**
L-08	CA466	110000	**11**
L-09	CA467	150000	**15**
L-10	CA468	41	**0.0041**

730 SE Maynard Road
Cary, NC 27511

TEL: 866-481-1412
TEL: 919-481-1413
FAX: 919-481-1442

Project: DVAMC - Blg 120, N1227410

Lab Code: C230133

METHOD: EPA SW846 7000B

CLIENT ID	LAB ID	PPM (µg/g)	CONCENTRATION % BY WEIGHT
L-11	CA469	2200	**0.22**
L-12	CA470	200	**0.020**
L-13	CA471	660	**0.066**
L-14	CA472	750	**0.075**

Reviewed By:

Tianbao Bai, Ph.D.
Laboratory Director

This method has been validated for sample weights of 0.020g or greater. When samples with a weight of less than that are analyzed those results fall outside of the scope of accreditations.
*** The analysis of composite wipe samples as a single samples is not included under AIHA accreditation.**

Minimum reporting limit is 10 µg total lead. Sample results denoted with a "less than" (<) sign contain less than 10.0 µg total lead, based on a 40ml sample volume.

Lead samples are not analyzed by Eurofins CEI Lead samples are submitted to an AIHA ELLAP accredited laboratory for lead analysis of soil, dust, paint, and TCLP samples.
Laboratory results represent the analysis of samples as submitted by the client. Information regarding sample location, description, area, volume, etc., was provided by the client. Unless notified in writing to return samples, Eurofins CEI discards client samples after 30 days. This report shall not be reproduced, except in full, without the written consent of Eurofins CEI.

Information provided by customer includes customer sample ID, location, volume and area as well as date and time of sampling.

REGULATORY LIMITS

OSHA Standard: No safe limit.
Consumer Products Safety Standard: Greater than 0.009% lead by weight.
Federal Lead Standard / HUD: 0.5% lead by weight.

LEGEND

µg = microgram
ml = milliliter
ppm = parts per million
Pb = lead
g = grams
wt = weight

End of Report

Attachment 3:

November 2018 Lead Paint Testing Report

Lead Based Paint Inspection

Dayton VA Medical Center
Building 120

November 2018

TABLE OF CONTENTS

1 Executive Summary
2 General Information
3 Methodology
4 Areas Containing Lead Based Paint
5 XRF Testing Results
6 Picture Log
7 Certifications

Executive Summary

HGS Engineering, Inc. project leads for this contract were Tim Thompson, the Project Manager and EPA Trained Lead Inspector and Efren Perez, an EPA Trained Lead Inspector.

Building 120 is a Main Library-Museum with 3 floors. Located at 4100 W Third St, Dayton, OH, it is a 16,800 square feet building built in 1880.

On 15 August 2018 Tim Thompson, an EPA Trained Lead Inspector, and Efren Perez, an EPA Trained Lead Inspector performed a lead base paint inspection of building 120. The inspection included areas that were painted or assumed to have been painted and were tested using a Lead Paint Analyzer. HGS Engineering, Inc. conducted the lead testing in all areas required and/or recommended by both EPA and OSHA.

HGS Engineering, Inc. took 10 samples in the basement; 4 samples of wooden beams, and 6 samples of the stairs with 4 testing positive. Exact locations are listed in the XRF Testing Results.

On the first floor, HGS took 64 samples in the front and rear entrances of the building; 48 samples of walls with 18 testing positive, 4 samples of windows with 4 testing positive, and 12 samples of doors with 8 testing positive. Exact locations are listed in the XRF Testing Results.

On the outside of building 120, HGS took 13 samples; 7 samples of walls with 2 testing positive, 2 samples of railing with 1 testing positive, and 4 samples of windows. Exact locations are listed in the XRF Testing Results.

General Information

HGS Engineering, Inc was contracted to conduct a lead base paint inspection of the Dayton Veterans Affairs Medical Center located in Dayton, Ohio. This VA Medical Center is located at 4100 W Third St, Dayton, OH 45428.

Tim Thompson, EPA Trained Lead Inspector met with Brad Herr, at the Dayton Veterans Affairs Medical Center on 31 July 2018.

Building 120 is a Main Library-Museum with 3 floors. Located at 4100 W Third St, Dayton, OH, it is a 16,800 square feet building built in 1880.

Methodology

Each accessible painted surface with a distinct painting history was tested using a Thermo Scientific portable XRF analyzer, model number XL2980, serial number 87961. The paint testing was accomplished in accordance with the manufacture's recommendations and the parameters listed in the EPA Performance Characteristics Sheet for the Thermo Scientific XRF analyzer. Samples were collected using protocols described by HUD, EPA and the American Society for Testing and Materials.

Areas Containing Lead Based Paint

Building	Floor	Room	Component	Substrate	Side	Condition	Color	Picture Number
120	Basement	Basement	Stairs	Metal		Good	Gray	682
120	Basement	Basement	Stairs	Metal		Good	Gray	682
120	Basement	Basement	Stairs	Metal		Good	Gray	682
120	Basement	Basement	Stairs	Metal		Good	Gray	682
120	1	Front Entrance	Wall	Drywall	C	Good	White	683
120	1	Front Entrance	Wall	Drywall	C	Good	White	683
120	1	Front Entrance	Wall	Drywall	C	Good	White	683
120	1	Front Entrance	Wall	Drywall	C	Good	White	683
120	1	Front Entrance	Wall	Drywall	C	Good	White	683
120	1	Front Entrance	Wall	Drywall	C	Good	White	683
120	1	Front Entrance	Wall	Drywall	D	Good	White	684
120	1	Front Entrance	Wall	Drywall	D	Good	White	684
120	1	Front Entrance	Wall	Drywall	D	Good	White	684
120	1	Front Entrance	Wall	Drywall	D	Good	White	684
120	1	Front Entrance	Wall	Drywall	D	Good	White	684
120	1	Front Entrance	Wall	Drywall	B	Good	White	686
120	1	Front Entrance	Wall	Drywall	B	Good	White	686
120	1	Front Entrance	Wall	Drywall	B	Good	White	686
120	1	Rear Entrance	Wall	Drywall	A	Good	White	687
120	1	Rear Entrance	Wall	Drywall	A	Good	White	687
120	1	Rear Entrance	Wall	Drywall	A	Good	White	687
120	1	Rear Entrance	Wall	Drywall	A	Good	White	687
120	1	Rear Entrance	Window	Wood		Good	White	692
120	1	Rear Entrance	Window	Wood		Good	White	692
120	1	Rear Entrance	Window	Wood		Good	White	692
120	1	Rear Entrance	Window	Wood		Good	White	692
120	Ground	Outside	Wall	Brick		Good	Pink	693
120	Ground	Outside	Wall	Brick		Good	Pink	693
120	Ground	Outside	Railing	Metal		Good	Black	694
120	Ground	Rear Entrance	Door	Wood		Good	White	696
120	Ground	Rear Entrance	Door	Wood		Good	White	696
120	Ground	Rear Entrance	Door	Wood		Good	White	696
120	Ground	Rear Entrance	Door	Wood		Good	White	696
120	Ground	Rear Entrance	Door	Wood		Good	White	696
120	Ground	Front Entrance	Door	Wood		Good	Yellow	697
120	Ground	Front Entrance	Door	Wood		Good	Yellow	697
120	Ground	Front Entrance	Door	Wood		Good	Yellow	697

XRF Testing Results

Index	Reading No	Date/Time	Site	Building	Floor	Room	Component	Substrate	Side	Condition	Color	Picture Number	Duration	Results	Depth Index	Action Level	Pb	Pb Error
3762	3762	8/15/2018 9:21	Dayton VAMC	120			Calibration						0.14	Negative	1	1	<LOD	0.01
3763	3763	8/15/2018 9:21	Dayton VAMC	120			Calibration						0.15	Negative	10	1	<LOD	0.87
3764	3764	8/15/2018 9:22	Dayton VAMC	120			Calibration						0.15	Negative	1	1	<LOD	0.01
3765	3765	8/15/2018 9:23	Dayton VAMC	120	Basement	Basement	Beams	Wood		Good	Green	681	0.14	Negative	1	1	<LOD	0.01
3766	3766	8/15/2018 9:23	Dayton VAMC	120	Basement	Basement	Beams	Wood		Good	Green	681	0.15	Negative	1	1	<LOD	0.01
3767	3767	8/15/2018 9:24	Dayton VAMC	120	Basement	Basement	Beams	Wood		Good	Green	681	0.15	Negative	1	1	<LOD	0.01
3768	3768	8/15/2018 9:24	Dayton VAMC	120	Basement	Basement	Beams	Wood		Good	Green	681	0.14	Negative	10	1	<LOD	0.75
3769	3769	8/15/2018 9:24	Dayton VAMC	120	Basement	Basement	Stairs	Metal		Good	Gray	682	0.15	Negative	1	1	<LOD	0.12
3770	3770	8/15/2018 9:24	Dayton VAMC	120	Basement	Basement	Stairs	Metal		Good	Gray	682	0.15	Negative	1	1	<LOD	0.12
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3775	3775	8/15/2018 9:25	Dayton VAMC	120	1	Front Entrance	Wall	Drywall	C	Good	White	683	0.15	Negative	1	1	<LOD	0.16
3776	3776	8/15/2018 9:25	Dayton VAMC	120	1	Front Entrance	Wall	Drywall	C	Good	White	683	0.15	Negative	1	1	<LOD	0.13
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3781	3781	8/15/2018 9:26	Dayton VAMC	120	1	Front Entrance	Wall	Drywall	C	Good	White	683	0.15	Negative	1.22	1	<LOD	0.5
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3787	3787	8/15/2018 9:27	Dayton VAMC	120	1	Front Entrance	Wall	Drywall	D	Good	White	684	0.48	Negative	1.51	1	0.26	0.13
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3790	3790	8/15/2018 9:27	Dayton VAMC	120	1	Front Entrance	Wall	Drywall	A	Good	White	685	0.15	Negative	1	1	<LOD	0.16
3791	3791	8/15/2018 9:27	Dayton VAMC	120	1	Front Entrance	Wall	Drywall	A	Good	White	685	0.15	Negative	1	1	<LOD	0.05
3792	3792	8/15/2018 9:27	Dayton VAMC	120	1	Front Entrance	Wall	Drywall	A	Good	White	685	0.15	Negative	1	1	<LOD	0.15
3793	3793	8/15/2018 9:27	Dayton VAMC	120	1	Front Entrance	Wall	Drywall	A	Good	White	685	0.15	Negative	1	1	<LOD	0.13
3794	3794	8/15/2018 9:27	Dayton VAMC	120	1	Front Entrance	Wall	Drywall	A	Good	White	685	0.14	Negative	1	1	<LOD	0.1
3795	3795	8/15/2018 9:28	Dayton VAMC	120	1	Front Entrance	Wall	Drywall	B	Good	White	686	0.14	Negative	1	1	<LOD	0.45
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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3803	3803	8/15/2018 9:29	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	B	Good	White	688	0.15	Negative	1	1	<LOD	0.01
3804	3804	8/15/2018 9:29	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	B	Good	White	688	0.15	Negative	1	1	<LOD	0.04
3805	3805	8/15/2018 9:30	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	B	Good	White	688	0.15	Negative	1	1	<LOD	0.01
3806	3806	8/15/2018 9:30	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	B	Good	White	688	0.15	Negative	1	1	<LOD	0.07
3807	3807	8/15/2018 9:30	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	B	Good	White	688	0.16	Negative	1	1	<LOD	0.01
3808	3808	8/15/2018 9:30	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	C	Good	White	689	0.15	Negative	1	1	<LOD	0.06
3809	3809	8/15/2018 9:30	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	C	Good	White	689	0.15	Negative	1	1	<LOD	0.07
3810	3810	8/15/2018 9:30	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	C	Good	White	689	0.16	Negative	1	1	<LOD	0.42
3811	3811	8/15/2018 9:30	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	C	Good	White	689	0.15	Negative	1	1	<LOD	0.3
3812	3812	8/15/2018 9:30	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	C	Good	White	689	0.15	Negative	1	1	<LOD	0.16
3813	3813	8/15/2018 9:30	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	C	Good	White	689	0.14	Negative	1	1	<LOD	0.38
3814	3814	8/15/2018 9:30	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	D	Good	White	690	0.15	Negative	1	1	<LOD	0.08
3815	3815	8/15/2018 9:31	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	D	Good	White	690	0.15	Negative	1	1	<LOD	0.01
3816	3816	8/15/2018 9:31	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	D	Good	White	690	0.15	Negative	1	1	<LOD	0.01
3817	3817	8/15/2018 9:31	Dayton VAMC	120	1	Rear Entrance	Wall	Drywall	D	Good	White	690	0.15	Negative	1	1	<LOD	0.01
3818	3818	8/15/2018 9:31	Dayton VAMC	120	1	Rear Entrance	Wall	Brick	A	Good	White	691	0.15	Negative	1	1	<LOD	0.1
3819	3819	8/15/2018 9:31	Dayton VAMC	120	1	Rear Entrance	Wall	Brick	A	Good	White	691	0.15	Negative	1	1	<LOD	0.06
3820	3820	8/15/2018 9:32	Dayton VAMC	120	1	Rear Entrance	Wall	Brick	A	Good	White	691	0.15	Negative	1	1	<LOD	0.06
3821	3821	8/15/2018 9:32	Dayton VAMC	120	1	Rear Entrance	Wall	Brick	A	Good	White	691	0.15	Negative	1	1	<LOD	0.07
3822	3822	8/15/2018 9:32	Dayton VAMC	120	1	Rear Entrance	Wall	Brick	A	Good	White	691	0.14	Negative	1	1	<LOD	0.07
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3829	3829	8/15/2018 9:33	Dayton VAMC	120	Ground	Outside	Wall	Brick		Good	Pink	693	0.15	Negative	1	1	<LOD	0.06
3830	3830	8/15/2018 9:33	Dayton VAMC	120	Ground	Outside	Wall	Brick		Good	Pink	693	0.15	Negative	1	1	<LOD	0.13
3831	3831	8/15/2018 9:33	Dayton VAMC	120	Ground	Outside	Wall	Brick		Good	Pink	693	0.15	Negative	1	1	<LOD	0.09
3832	3832	8/15/2018 9:33	Dayton VAMC	120	Ground	Outside	Wall	Brick		Good	Pink	693	0.15	Negative	1	1	<LOD	0.1
3833	3833	8/15/2018 9:33	Dayton VAMC	120	Ground	Outside	Wall	Brick		Good	Pink	693	0.16	Negative	1	1	<LOD	0.08
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3835	3835	8/15/2018 9:33	Dayton VAMC	120	Ground	Outside	Railing	Metal		Good	Black	694	0.15	Negative	1	1	<LOD	0.22
3836	3836	8/15/2018 9:33	Dayton VAMC	120	Ground	Outside	Window	Wood		Good	Cream	695	0.15	Negative	1	1	<LOD	0.11
3837	3837	8/15/2018 9:34	Dayton VAMC	120	Ground	Outside	Window	Wood		Good	Cream	695	0.15	Negative	1	1	<LOD	0.53
3838	3838	8/15/2018 9:34	Dayton VAMC	120	Ground	Outside	Window	Wood		Good	Cream	695	0.15	Negative	1	1	<LOD	0.33
3839	3839	8/15/2018 9:34	Dayton VAMC	120	Ground	Outside	Window	Wood		Good	Cream	695	0.15	Negative	1	1	<LOD	0.39
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Index	Reading No	Date/Time	Site	Building	Floor	Room	Component	Substrate	Side	Condition	Color	Picture Number	Duration	Results	Depth Index	Action Level	Pb	Pb Error
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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3845	3845	8/15/2018 9:36	Dayton VAMC	120	Ground	Front Entrance	Door	Wood		Good	Yellow	697	0.15	Negative	1.01	1	< LOD	0.44
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3847	3847	8/15/2018 9:36	Dayton VAMC	120	Ground	Front Entrance	Door	Wood		Good	Yellow	697	0.15	Negative	1	1	< LOD	0.44
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3849	3849	8/15/2018 9:36	Dayton VAMC	120	Ground	Front Entrance	Door	Wood		Good	Yellow	697	0.14	Negative	3	1	< LOD	0.38
3850	3850	8/15/2018 9:36	Dayton VAMC	120	Ground	Front Entrance	Door	Wood		Good	Yellow	697	0.15	Negative	3	1	< LOD	0.51
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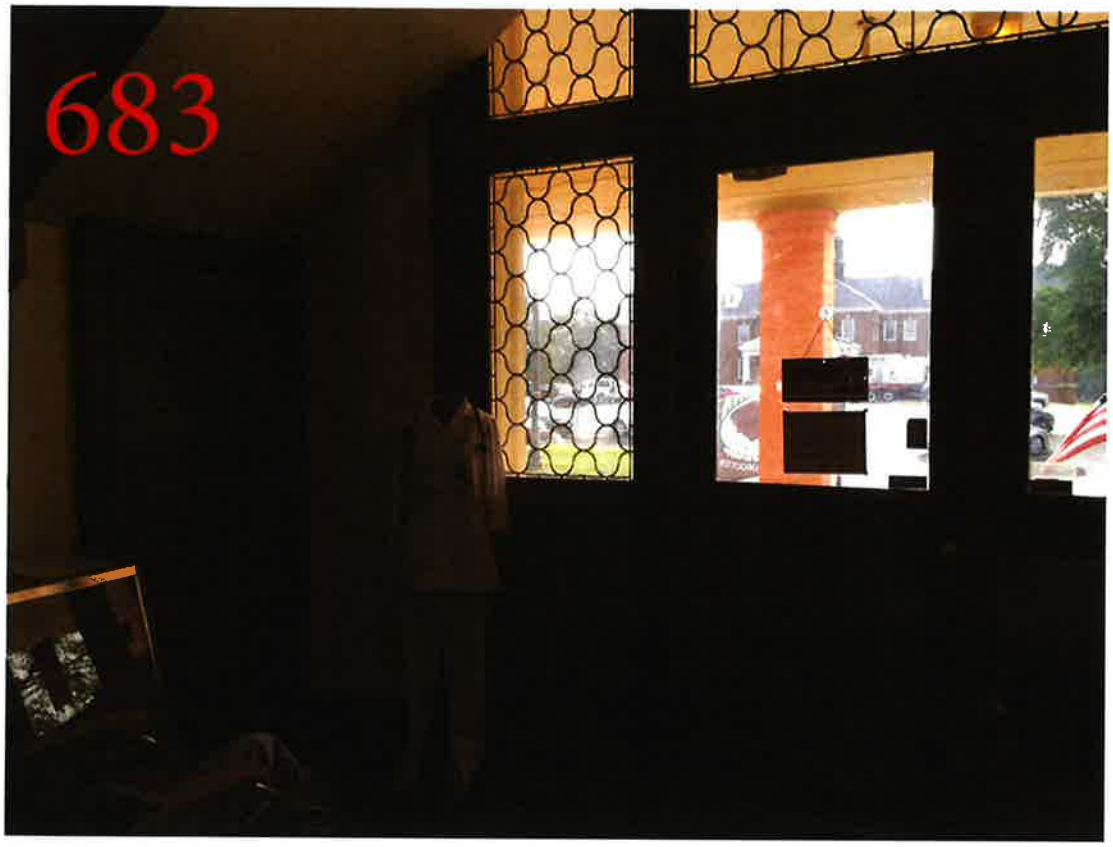
	Negative
	Positive
	Inconclusive

Picture Log

681

682

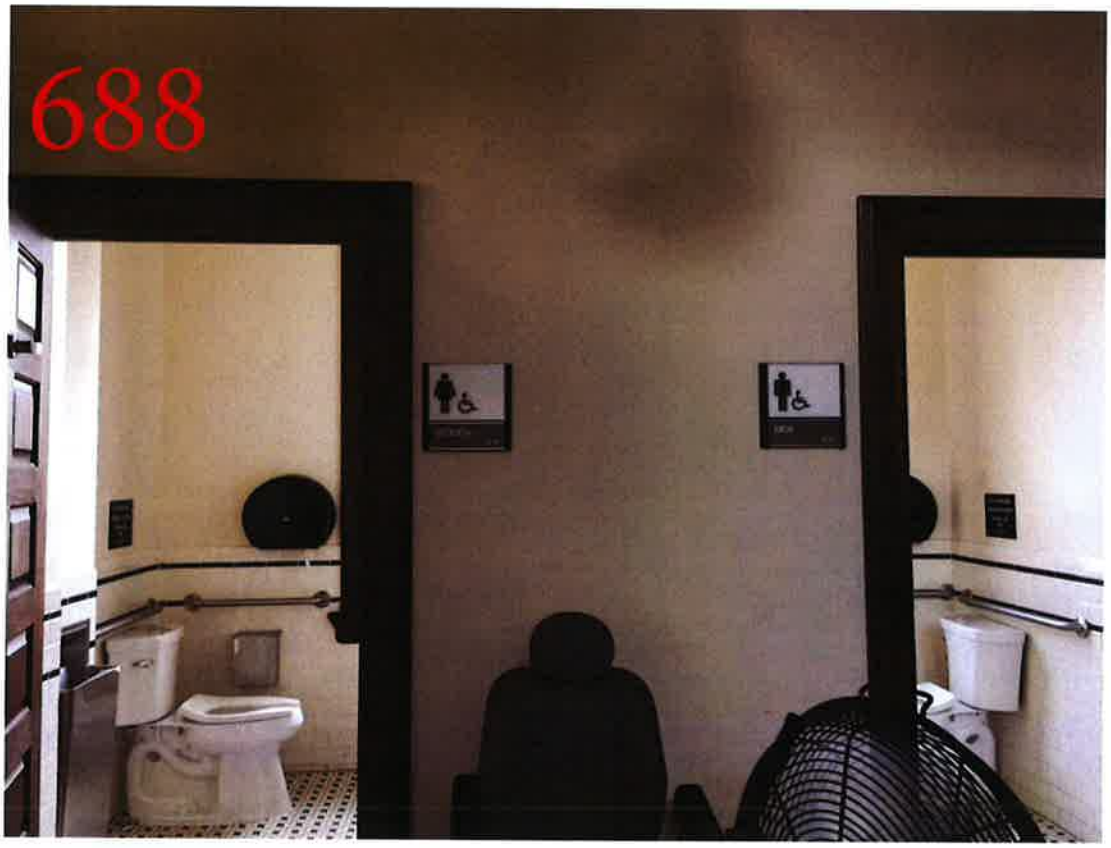

683

684

685
YOUR SAFETY
Guns, Knives or
Other Weapons Allowed

686
Dayton
Soldiers Home

687


688

689
Use Other
Door

690

691

692

693

694

695

696

Certifications

The Environmental Institute

Timothy Thompson

Social Security Number - XXX-XX-0262
HGS Engineering, Inc. - 1121 Noble Street - Anniston, Alabama 36201

Has completed coursework and satisfactorily passed the hands-on skills assessment and an examination that meets training criteria in accordance with requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities as regulated by Georgia DNR/EPD Chapter 391-3-24 and U. S. EPA TSCA 40 CFR Part 745 for the refresher course titled

Lead Inspector Refresher

August 23, 2018
Course Date

1849
Certificate Number

August 23, 2018
Examination Date

August 22, 2020
Georgia & Alabama Expiration Date

August 22, 2021
EPA Expiration Date

Bonnie B. Maurras - Principal Instructor

David W. Hogue - Training Manager

(Approved by the ABIH Certification Maintenance Committee for 1 CM point - Approval #11-584)
TEI - 1841 West Oak Parkway, Suite F - Marietta, GA 30062 - (770) 427-3600 - www.tei-atl.com
(State of Georgia Accredited - Certification No. 20-0799-006SR - September 21, 1999)

The Environmental Institute

Efren Perez Rivera

Social Security Number - XXX-XX-2099
HGS Engineering Inc. - 1121 Noble Street - Anniston, Alabama 36201

Has completed coursework and satisfactorily passed the hands-on skills assessment and an examination that meets training criteria in accordance with requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities as regulated by Georgia DNR/EPD Chapter 391-3-24 and U. S. EPA TSCA 40 CFR Part 745 for the initial course titled

Lead Inspector: EPA
(Target Housing & Child-Occupied Facilities)

May 7-9, 2018
Course Date

2419
Certificate Number

May 9, 2018
Examination Date

November 9, 2018
Interim Expiration Date (per EPA)

May 8, 2020
Expiration Date (per Georgia)

May 8, 2021
Expiration Date (per EPA)

THE ENVIRONMENTAL INSTITUTE 30th ANNIVERSARY 1988 - 2018

Thomas G. Laubenthal - Principal Instructor

David W. Hogue - Training Manager

(Approved by the ABIH Certification Maintenance Committee for 3 CM points - Approval #11-563)
TEI - 1841 West Oak Parkway, Suite F - Marietta, Georgia 30062 - (770) 427-3600 - www.tei-atl.com
(State of Georgia Accredited - Certification No. 20-0799-006I - January 15, 1997)

SECTION 02 84 00
ANIMAL WASTE REMEDIATION

PART 1 - GENERAL

1.1 SUMMARY OF THE WORK

A. Contract Documents and Related Requirements: Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show or describe the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Remediation Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Remediation Contractor. All costs incurred due to such action are also the responsibility of the Remediation Contractor. Due to the hazard posed by histoplasma capsulatum spores (which can cause a fungal infection called histoplasmosis) in bat guano and other animal excrement/wastes, remediation of wastes is conducted in a manor like that of asbestos remediation.

B. Extent of Work:

1. Below is a brief description of the estimated quantities of guano and animal waste to be remediated. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy themselves of the actual quantities to be remediation. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.
2. Removal, clean-up and disposal guano and animal waste in the following locations:

Animal Waste Location	Estimated Quantity
The attic / upper portion of Building 119 (Putnum Library) and the bell tower of Building 120 (Catholic Church)	~ 3,175 Total Square Feet of Surfaces with Contaminated Animal Waste

C. Related Work:

1. Section 07 84 00, FIRESTOPPING

2. Section 02 41 00, DEMOLITION
3. Section 02 82 11, TRADITIONAL ASBESTOS REMEDIATION
4. Section 02 82 13.13, GLOVEBAG ASBESTOS REMEDIATION
5. Section 02 82 13.19, ASBESTOS FLOOR TILE AND MASTIC REMEDIATION
6. Section 02 82 13.31, TRANSITE TYPE REMEDIATION
7. Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL
8. Division 09, FINISHES
9. Division 22, PLUMBING
10. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
11. Section 22 05 19, METERS AND GAUGES FOR PLUMBING PIPING
12. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING
13. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING
14. Section 22 05 33, HEAT TRACING FOR PLUMBING PIPING
15. Section 22 11 00, FACILITY WATER DISTRIBUTION
16. Section 22 13 00, FACILITY SANITARY AND VENT PIPING SEWERAGE
17. Section 23 05 11, COMMON WORK RESULTS FOR HVAC
18. Section 22 13 23, SANITARY WASTE INTERCEPTORS
19. Section 22 14 00, FACILITY STORM DRAINAGE
20. Section 22 66 00, CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES
21. Section 23 07 11, HVAC AND BOILER PLANT INSULATION
22. Section 23 11 23, FACILITY NATURAL-GAS PIPING
23. Section 23 21 13, HYDRONIC PIPING
24. Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING
25. Section 23 31 00, HVAC DUCTS AND CASINGS
26. Section 23 37 00, AIR OUTLETS AND INLETS

D. Tasks:

1. The work tasks are summarized as follows:
   a. Pre-remediation activities including pre-remediation meeting(s), inspection(s), notifications, permits, submittal approvals, regulated area preparations, emergency procedures arrangements, and standard operating procedures for remediation work.
   b. Remediation activities including removal, clean-up and disposal of waste, recordkeeping, security, monitoring, and inspections.
   c. Cleaning and decontamination activities including final visual inspection, and certification of completion (attachment #1).

E. Contractors Use of Premises:

1. The Contractor and Contractor's personnel shall cooperate fully with the VA representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.
2. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedures. VA Design and Construction Procedures drawings of partially occupied buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste; the path of transport to outside the building; and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA representative through the pre-remediation plan of action. The following limitations of use shall apply to existing facilities shown on drawings.

1.2 VARIATIONS IN QUANTITY

A. The quantities and locations of animal waste contamination as indicated on the drawings and/or the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to animal waste. Accordingly, minor variations (+/- 10 percent) in quantities of animal waste contamination within the remediation area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered animal waste and those prices shall be used for additional work required under the contractor.

1.3 STOP WASTE REMOVAL

A. If the Contracting Officer; their field representative; the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal **Stop Waste Removal Order**, the Contractor/Personnel shall immediately stop all remediation activities and maintain HEPA filtered negative pressure air flow in the containment. If a verbal Stop Waste Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as it is practicable. The Contractor shall not resume any waste removal activity until authorized to do so in writing by the VA Contracting Officer. A stop waste removal order may be issued at any time the VA Contracting Officer determines remediation conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor’s competent person to

the VA Contracting Office or field representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as practical. The Contractor shall immediately stop waste removal/disturbance activities and initiate contamination reduction activities if:

1. breach or break in remediation area containment barrier(s);
2. less than –0.02-inch WCG pressure in the remediation area;
3. serious injury/death at the site;
4. fire/safety emergency at the site;
5. respiratory protection system failure;
6. power failure;
7. any visible emissions observed outside the remediation area; or
8. failure to follow project specification requirements.

1.4 DEFINITIONS

A. General: Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

B. Glossary:

Abatement - Also means Remediation

Animal Waste – animal excrement. This includes feces, guano, and urine.

Authorized person - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.

Authorized visitor - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA).

Barrier - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.

Containment Barrier - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.

Critical Barrier - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of 2-layers of 6-mil independently installed plastic sheeting (Polyethylene) secured in place at openings such as doors, windows, penetrations or any other opening into the regulated area.

Primary Barrier – Plastic barriers placed over critical barriers and exposed directly to remediation work or to secondary barrier.

Secondary Barrier - Any additional plastic barriers used to isolate and provide protection from debris during remediation work.

Breathing zone - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.

Building/facility owner - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which activities take place.

Certified Industrial Hygienist (CIH) - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.

Clean room/Changing room - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.

Competent person - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing animal waste hazards in the workplace and selecting the appropriate control strategy for exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f);

Contractor's Professional Industrial Hygienist (CPIH/CIH) - The remediation contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of a PIH and may report to a certified industrial hygienist (CIH).

Crawlspace – An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain animal waste.

Decontamination area/unit - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with animal waste.

Demolition - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of animal waste-contaminated materials.

Disposal bag - Typically 6-mil thick sift-proof, dustproof, leak-tight container used to package and transport animal waste from remediation areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.

Drum - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.

Employee exposure - The exposure to airborne fungal spores that would occur if the employee were not wearing respiratory protection equipment.

Enclosure - The construction of an airtight, impermeable, permanent barrier around waste to control the release of spread of fungal spores from the material and to eliminate access to the material.

EPA Registered Fungicide - A fungicide that has been registered and approved by the US EPA under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

Equipment room - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

Filter - Media used in respirators, vacuums, or other machines to remove particulate from air.

Firestopping - Material used to close the open parts of a structure in order to prevent a fire from spreading.

High efficiency particulate air (HEPA) filter – An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

HEPA vacuum - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining fibers/spores/dust, etc..

HVAC - Heating, Ventilation and Air Conditioning

Industrial hygienist (IH) - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).

Industrial hygienist technician (IH Technician) - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned.

Negative pressure - Air pressure, which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02-inch water column gauge inside the negative pressure enclosure.

Negative pressure respirator - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.

Organic vapor cartridge - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.

Outside air - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.

Owner/operator - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

Personal protective equipment (PPE) – equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, fall protection, and respirators.

Pipe tunnel – An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, debris or

asbestos-contaminated soil – caution must be utilized. An existing asbestos survey shall be available for review prior to start of work.

Polyethylene sheeting - Strong plastic barrier material 4 to 6-mils thick, semi-transparent, flame retardant per NFPA 241.

Positive/negative fit check - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator, respectively.

Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.32(f); has completed two specialized EPA approved courses on management and supervision of remediation projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH/CIH) or Contractor's PIH (CPIH/CIH).

Assigned protection factor - A value assigned by OSHA/NIOSH to indicate the expected protection provided by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.

Qualitative fit test (QLFT) - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.

Quantitative fit test (QNFT) - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.

Remediation – Procedures to control fungal spore and pathogen release from animal waste. Includes removal, demolition, disinfection and renovation activities related to animal waste.

Remediation Area - An area established by the employer to demarcate where waste removal work is conducted, and any adjoining area where debris and waste from such work may accumulate.

Repair - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates.

Shower room - The portion of the PDF where personnel shower before leaving the regulated area.

Supplied air respirator (SAR) - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-2018.

VA Professional Industrial Hygienist (VPIH/CIH) – The Department of Veterans Affairs Professional Industrial Hygienist must meet the qualifications of a VPIH and may report to a Certified Industrial Hygienist (CIH).

VA Representative - The VA official responsible for on-going project work.

VA Total – means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.

Visible emissions - Any emissions, which are visually detectable without the aid of instruments, of animal waste material or from materials contaminated by animal waste.

Waste/Equipment decontamination facility (W/EDF) – The area in which equipment is decontaminated before removal from the remediation area.

Waste generator - Any owner or operator whose act or process produces animal waste material.

Waste shipment record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of animal waste or materials contaminated by animal waste.

Wet cleaning - The process of thoroughly eliminating, by wet methods, any animal waste contamination from surfaces or objects.

C. Referenced Standards Organizations: See Section 01 42 19 REFERENCED STANDARDS.

1.5 APPLICABLE CODES AND REGULATIONS

A. General Applicability of Codes, Regulations, and Standards:

1. All work under this contract shall be done in strict accordance with all applicable Federal, State, and Local regulations, standards and codes governing remediation, and any other trade work done in conjunction with the remediation. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.
2. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.
3. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system and/or the Contractor's on-site Field Office. These standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 may be made available electronically.

B. Remediation Contractor Responsibility: The Remediation Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to all aspects of the animal waste remediation project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE), respiratory protection, and respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Contractor will incur all costs of the CPIH/CIH,

including all sampling/analytical costs to assure compliance with OSHA/EPA/State/Local requirements related to failure to comply with the regulations applicable to the work.

C. Federal Requirements:

1. Federal requirements which govern animal wastes remediation include, but are not limited to, the following regulations:

a. Occupational Safety and Health Administration **(OSHA)**

1)Title 29 CFR 1926 Subpart E - Personal Protective Equipment and Life Saving Equipment

2)Title 29 CFR 1910.134 - Respiratory Protection

3)Title 29 CFR 1926 - Construction Industry Standards

4)Title 29 CFR 1926.33 - Access to Employee Exposure and Medical Records

5)Title 29 CFR 1926.59 same as 1910.1200 - Hazard Communication

6)Title 29 CFR 1926 Subpart C – General Safety and Health Provisions and Subpart D – Occupational Health and Environmental Controls

b. Department of Transportation **(DOT)**

1)Title 49 CFR 171 - 180 – Transportation

D. State Requirements:

1. State requirements that apply to the animal waste remediation work, disposal, clearance, etc., include, but are not limited to, the following.

a. Ohio Administrative Code Rule 1501:31-15-03 – Nuisance wild animal control

E. Local Requirements:

If local requirements are more stringent than federal or state standards, the local standards are to be followed.

F. Standards:

1. Standards which govern animal waste remediation activities include, but are not limited to, the following:

a. American National Standards Institute (ANSI)/ASSP Z9.2-2018 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI/ASSE Z88.2-2015 - Practices for Respiratory Protection.

b. Underwriters Laboratories (UL) 586-2009 - UL Standard for Safety of HEPA Filter Units, 9th Edition; ANSI Approval 2017-12-19.

2. Standards which govern encapsulation work include, but are not limited to the following:

a. American Society for Testing and Materials International (ASTM)

3. Standards which govern the fire and safety concerns in remediation work include, but are not limited to, the following:

a. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

b. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.

c. NFPA 101 - Life Safety Code

G. EPA Guidance Documents:

H. Permits/Licenses: The contractor shall apply for and have all required permits and licenses to perform waste removal work as required by Federal, State, and Local regulations.

I. Posting and Filing of Regulations: Maintain two (2) copies of applicable Federal, State, and Local regulations. Post one copy of each in the clean room at the remediation area where workers will have daily access to the regulations and keep another hard copy or electronic copy in the Contractor's office.

J. VA Responsibilities prior to commencement of work:

1. Notify occupants adjacent to remediation areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment, and personal possessions to avoid unauthorized access into the remediation area.

K. Emergency Action Plan and Arrangements:

1. An Emergency Action Plan shall be developed prior to commencing remediation activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1926, Subpart C, Standard 1926.35 Employee Emergency Action Plans.
2. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the remediation area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
3. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned remediation activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.
4. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.
5. Employees shall be trained in remediation area/site evacuation procedures in the event of workplace emergencies.
   a. For non-life-threatening situations - employees injured or otherwise incapacitated shall be decontaminated following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
   b. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, medical personnel shall remove them from the regulated area if back or neck injury is present, and secure proper medical treatment.

6. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
7. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.
8. The Emergency Action Plan shall provide for a Contingency Plan if an incident occurs that may require the modification of the standard operating procedures during remediation. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that animal waste remediation work is stopped and containment is continued until correction of the problem.

L. Pre-Construction Meeting:

1. Prior to commencing the work, the Contractor shall meet with the VA Certified Industrial Hygienist (VPIH/CIH) to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:
   a. Proof the Competent Person(s) is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person(s) shall also be presented.
   b. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
   c. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.
   d. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.103.
   e. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1910.134 (f)
   f. A copy of the Contractor's Animal Waste Hazard Remediation Plan. In these procedures, the following information must be detailed, specific for this project.
      1)Remediation area preparation procedures;
      2)Notification requirements and procedure of additional Employers on a multi-employer worksite;
      3)Decontamination area set-up/layout and decontamination procedures for employees;
      4)Remediation methods/procedures and equipment to be used;
      5)Personal protective equipment to be used.
   g. At this meeting the Contractor shall provide all submittals as required.

h. Procedures for handling, packaging and disposal of animal waste.

i. Emergency Action Plan and Contingency Plan Procedures.

1.6 PROJECT COORDINATION

A. The following are the minimum administrative and supervisory personnel necessary for coordination of the work.

1. Personnel:

a. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.

b. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; last four digits of social security number; qualifications; accreditation card with color picture, if required by state; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.

c. Minimum qualifications for Contractor and assigned personnel are:

1)The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of federal (and State or Local as applicable) EPA, and OSHA regulations in the past three (3) years; has adequate liability/occurrence insurance for animal waste remediation work as required by the state; is licensed in applicable state; has adequate and qualified personnel available to complete the work; has comprehensive standard operating procedures for animal waste remediation work; has adequate materials, equipment and supplies to perform the work.

2)The Competent Person has three (3) years of remediation experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; and has all required OSHA documentation related to medical and respiratory protection.

3)The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have three(3) years of monitoring experience and supervision of animal waste remediation projects; has participated as senior IH on three (3) animal waste remediation

projects, three (3) of which are similar in size and complexity as this project; training in animal waste remediation management, respiratory protection, and waste disposal; and has appropriate medical/respiratory protection records/documentation.

4) The Remediation Personnel shall have training on the standard operating procedures of the Contractor; have one year of animal waste remediation experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation.

d. All personnel shall comply with OSHA construction safety training as applicable and submit certification.

1.7 RESPIRATORY PROTECTION

A. General - Respiratory Protection Program: The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which follows OSHA requirements found at 29 CFR 1910.134. ANSI Standard Z88.2-2015 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for remediation activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c) - Respiratory Protection Program.

B. Respiratory Protection Program Coordinator: The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years of experience coordinating RPP of similar size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

C. Selection and Use of Respirators: The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit or in the onsite Contractor’s office, for reference by employees or authorized visitors.

D. Minimum Respiratory Protection: Shall be a ½-mask negative pressure air purifying respirator equipped with P100 filters. Respirator selection shall meet the requirements of 29 CFR 1910.134 (d)(3)(i)(A) Table 1, except as indicated in this paragraph. Remediation personnel must have a respirator for their exclusive use.

E. Medical Written Opinion: No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination, they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

F. Respirator Fit Test: All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A.

Quantitative fit tests shall be done for PAPRs which have been put into a motor/blower failure mode.

G. Respirator Fit Check: The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from entering the regulated area until resolution of the problem.

H. Maintenance and Care of Respirators: The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) Maintenance and Care of Respirators.

I. Supplied Air Systems: If a supplied air system is used, the system shall meet all requirements of 29 CFR 1910.134 and the ANSI/Compressed Gas Association (CGA) Commodity Specification for Air current requirements for Type 1 - Grade D breathing air. Low pressure systems are not allowed to be used on remediation projects. Supplied Air respirator use shall be in accordance with EPA/NIOSH publication EPA-560-OPTS-86-001 "A Guide to Respiratory Protection for the Asbestos Remediation Industry". The competent person on site will be responsible for the supplied air system to ensure the safety of the worker.

1.8 WORKER PROTECTION

A. Training of Remediation Personnel: Prior to beginning any remediation activity, all personnel shall be trained in the means at methods of the task they will perform. The Employer is responsible for ensuring that employees receiving training as detailed under any OSHA Construction standard required to perform their duties as required in 20 CFR 1926, and any additional State/Local requirements.

B. Remediation Area Entry Procedure: The Competent Person shall ensure that each time workers enter the remediation area; they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

C. Decontamination Procedure: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the remediation area.

1. When exiting the remediation area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.
2. Still wearing the respirator and completely naked, proceed to the shower. Showering is MANDATORY. Care must be taken to follow reasonable procedures in removing the respirator to avoid fungal spores. The following procedure is required as a minimum:
   a. Thoroughly wet body including hair and face. If using a PAPR hold blower above head to keep filters dry.

b. With respirator still in place, thoroughly decontaminate body, hair, respirator face piece, and all other parts of the respirator except the blower and battery pack on a PAPR. Pay particular attention to cleaning the seal between the face and respirator facepiece and under the respirator straps.

c. Take a deep breath, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.

3. Carefully decontaminate the facepiece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) carefully decontaminate battery pack with a wet rag being cautious of getting water in the battery pack thus preventing destruction. **(THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!)**
4. Shower and wash body completely with soap and water. Rinse thoroughly.
5. Rinse shower room walls and floor to drain prior to exiting.
6. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

D. Remediation Area Requirements: The Competent Person must have a solid understanding of the hazards presented by the work and required engineering controls. They must also have the authority to take action when changes need to be made to protect workers, building occupants, and the environment over the course of the project. The knowledge of hazards related to the work may have been obtained through a combination of experience on similar jobs and/or specialized training.

All personnel in the remediation area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

A. Description: Provide each remediation area with separate personnel decontamination facilities (PDF) and waste/equipment decontamination facilities (W/EDF). Ensure that the PDF are the only means of ingress and egress to the remediation area and that all equipment, bagged waste, and other material exit the regulated area only through the W/EDF.

B. General Requirements: All personnel entering or exiting a remediation area must go through the PDF and shall follow the requirements of these specifications. All waste, equipment and contaminated materials must exit the remediation area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF must be constructed of a minimum of 3 layers of 6-mil opaque fire-retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of three (3) layers of 6-mil poly shall also be used to cover the floor under

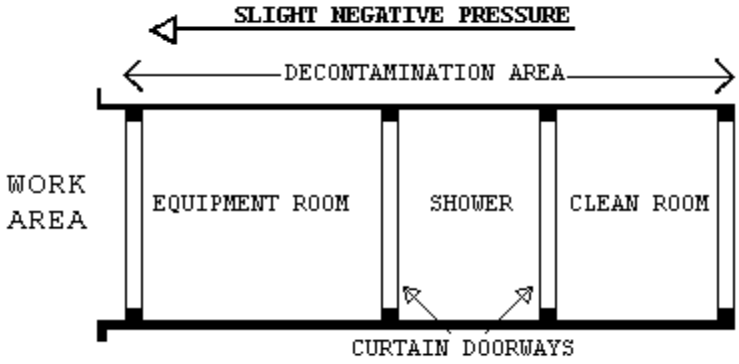
the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape or approved equivalent so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

C. Temporary Facilities to the PDF and W/EDF: The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention must be provided at the point of connection to the VA system. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141(d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel equipped with GFCI protection for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50-foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70 degrees F throughout the PDF and W/EDF.

D. Personnel Decontamination Facility (PDF): The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room which is connected to the regulated area. The PDF must be sized to accommodate the number of personnel scheduled for the project. The shower room, located in the center of the PDF, shall be fitted with as many portable showers as necessary to insure all employees can complete the entire decontamination procedure within 15 minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.

1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least three (3) layers of 6-mil opaque fire-retardant poly to provide an airtight room. Provide a minimum of 2 - 900 mm (3 foot) wide 6-mil poly opaque fire-retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry and sanitary condition. Shower overflow shall not be allowed into the clean room. Provide one (1) storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Male/Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male/female can enter or exit the PDF during his/her stay in the PDF.

2. Shower Room: The Competent Person shall assure that the shower room is a completely watertight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using airtight walls made from at least 3 layers of 6-mil opaque fire-retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Wastewater will be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final five (5) micron filter. Filters will be changed a minimum of daily or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as remediation waste.
3. Equipment Room: The Competent Person shall provide an equipment room which shall be an airtight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The Competent Person shall ensure that most gross contamination is removed from the outside of PPE, suits and respirators in the regulated work area, prior to entering the Equipment Room. The equipment room shall be separated from the regulated area by a minimum 3-foot-wide door made with two (2) layers of 6-mil opaque fire-retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by airtight walls and ceiling constructed of a minimum of three (3) layers of 6-mil opaque fire-retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6-mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area.
4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of two (2) layers of 6-mil opaque fire-retardant poly.

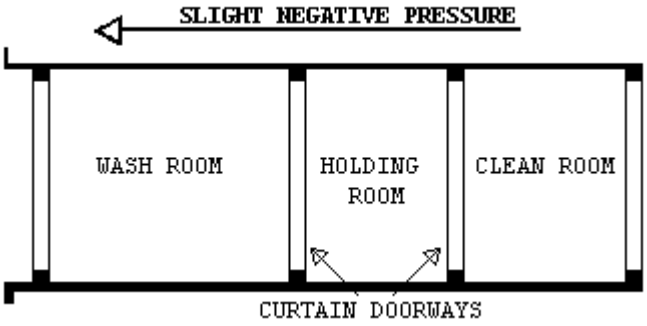


E. Waste/Equipment Decontamination Facility (W/EDF):

1. The Competent Person shall provide a W/EDF consisting of a washroom, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:
   a. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Washroom as an equipment bag and container cleaning station.
   b. Washroom: Provide a washroom for cleaning of bagged or containerized waste materials passed from the regulated area. Construct the washroom using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and three (3) layers of 6-mil fire retardant poly. Locate the washroom so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the washroom shall be constructed of two (2) layers of 6-mil fire retardant poly.
   c. Holding Room: Provide a holding room as a drop location for bagged materials passed from the washroom. Construct the holding room using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and three (3) layers of 6-mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the washroom to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of two (2) layers of 6-mil fire retardant poly.
   d. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 inches x 4 inches wood framing or approved equivalent and two (2) layers of 6-mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of two (2) layers of 6-mil fire retardant

poly. When a negative pressure differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.

e. The W/EDF shall be as follows: Washroom leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



F. Waste/Equipment Decontamination Procedures: At the washdown station in the regulated area, thoroughly wet clean contaminated equipment and/or sealed polyethylene bags and pass into Washroom after visual inspection. When passing anything into the Washroom, close all doorways of the W/EDF, other than the doorway between the washdown station and the Washroom. Keep all outside personnel clear of the W/EDF. Once inside the Washroom, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. At no time shall personnel from the clean side be allowed to enter the Washroom.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. General Requirements: Prior to the start of work, the contractor shall provide and maintain enough materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's representative.

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until remediation is completed.

3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mils. For floors and all other uses, sheeting of at least 6-mil shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
6. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape, poly tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or approved equivalent procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
7. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6-mil fire retardant poly.
8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and wastewater filtration system shall be provided by the Contractor.
9. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the remediation project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
10. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
11. Disposal bags – two (2) layers of 6-mil poly for animal waste marked if applicable to OSHA, EPA and DOT regulations.
12. The VA shall be provided an advance copy of the Safety Data Sheets (SDS) as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-start meeting submittal. Chlorinated compounds shall not be used with any spray adhesive or other product. Appropriate encapsulant(s) shall be provided.
13. OSHA BIOHAZARD demarcation signs, as many and as required by OSHA 29 CFR 1910.145(e)(4) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.

14. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

2.2 MONITORING, INSPECTION AND TESTING

A. Scope of Services of the VPIH/CIH Consultant:

1. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the remediation area; and assure clearance at the end of the project. In addition, their work includes performing the final inspection to determine whether the remediation area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:
   a. Task 1: Perform unannounced visits inside the regulated work areas to spot check overall compliance of work with contract/specifications. These visits may include any inspection, inside and outside the remediation area and all aspects of the operation except personnel monitoring.
   b. Task 2: Provide support to the VA representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.
   c. Task 3: Perform a final inspection of a decontaminated regulated area at the conclusion of the remediation to certify compliance with all regulations and VA requirements/specifications.
   d. Task 4: Provide a final report summarizing the completed remediation project and VPIH activities.
2. All documentation, inspection results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.
3. The monitoring and inspection results of the VPIH/CIH may be used by the VA to issue any Stop Removal orders to the Contractor during remediation work and to accept or reject a remediation area or building as decontaminated.

B. Monitoring, Inspection and Testing by Contractor CPIH/CIH: The Contractor's CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor's personnel. Safety and health conditions and the provision of those conditions inside the remediation area for all persons entering the remediation area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the remediation area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH

Technician shall have participated in five remediation projects collecting personal and area samples and have experience in substantially similar projects in size and scope. The analytical laboratory used by the Contractor to analyze the samples shall be AIHA accredited for the analytical method and approved by the VA prior to start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for personal and area air monitoring as described the relevant OSHA standard. This log shall be made available to the VA representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, and flow rate. Analytical results shall be included in the log once they are available. . The CPIH/CIH shall collect and analyze samples for each representative job being done in the remediation area, i.e., removal, wetting, clean-up, and load-out. The CPIH/CIH will perform inspection and testing at the final stages of remediation for each remediation area as specified in the CPIH/CIH responsibilities. Additionally, the CPIH/CIH will monitor and record pressure readings within the containment daily with a minimum of two readings at the beginning and at the end of a shift and submit the data in the daily report.

2.3 ANIMAL WASTE HAZARD REMEDIATION PLAN

A. The Contractor shall have an established an Animal Waste Hazard Remediation Plan (AWHAP) in printed form and loose-leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the procedures to be followed during all phases of the work by the Contractor's personnel. The AWHAP must be modified as needed to address specific requirements of this project and the specifications. The AHAP shall be submitted for review and approval to the VA prior to the start of any remediation work. The minimum topics and areas to be covered by the AHAPs are:

1. Minimum Personnel Qualifications
2. Emergency Action Plan/Contingency Plans and Arrangements
3. Security and Safety Procedures
4. Respiratory Protection/Personal Protective Equipment Program and Training
5. Medical Surveillance Program and Recordkeeping
6. Remediation Area Requirements - Containment Barriers/Isolation of Regulated Area
7. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF)
8. Negative Pressure Systems Requirements
9. Monitoring, Inspections, and Testing
10. Removal Procedures for Animal Waste
11. Removal of Contaminated Soil (if applicable)
12. Disposal of animal waste waste/ contaminated equipment
13. Remediation Area Decontamination/Clean-up

14. Remediation Area Visual and Air Clearance
15. Project Completion/Closeout

2.4 SUBMITTALS

A. Pre-Start Meeting Submittals:

1. Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:
   a. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
   b. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
   c. Submit Animal Waste Hazard Remediation Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.
   d. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
      1)Supplied air system, negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
      2)Wastewater filtration system, shower system, containment barriers.
      3)Anti-fungal agents, disinfectants, surfactants, handheld sprayers, airless sprayers, and fire extinguishers.
      4)Respirators, protective clothing, fall protection and other required personal protective equipment.
      5)Fire safety equipment to be used in the regulated area.
   e. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for animal waste disposal; the landfill's requirements for animal waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of training for transportation personnel shall be provided.
   f. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.

g. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air samples. Personal air monitoring must be done in accordance with current edition the NIOSH Manual of Analytical Methods(NMAM).

h. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.

1)Remediation Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Remediation; Duration; Cost; Reference Name/Phone Number; Final Clearance; Completion Date

2)List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution

3)List regulatory citations (e.g., OSHA), notices of violations (e.g., Federal and state EPA), penalties, and legal actions taken against the company including the company's officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.

i. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1910.134 and that the company has a written respiratory protection program, and maintains recordkeeping in accordance with the above regulation. Submit the phone number and doctor/clinic/hospital used for respiratory protection questionnaire evaluations.

1)CPIH/CIH and IH Technician: Name; years of remediation experience; list of projects similar to this one; proof of remediation training, certificates, licenses, professional affiliations; medical opinion (respirator use); and current respirator fit test.

2)Competent Person(s)/Supervisor(s): Number; names; last four digits of social security numbers; years of remediation experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of remediation training; maximum number of personnel supervised on a project; medical opinion (respirator use); and current respirator fit test.

3)Workers: Numbers; names; last four digits of social security numbers; years of remediation experience; certificates, licenses, accreditations; proof of training in remediation and respiratory protection; medical opinion (respirator use); and current respirator fit test.

j. Submit copies of relevant State licenses; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that

animal waste remediation activities are covered by the policy; copy of AWHAPs incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of remediation workers conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and standard operating procedures; and copies of monitoring results of the five referenced projects listed and analytical methods used.

k. Rented equipment must be decontaminated prior to returning to the rental agency.

l. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all SDS and application instructions.

B. Submittals During Remediation:

1. The Competent Person shall maintain and submit a daily log at the remediation area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the remediation area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; and representative air monitoring and results, if collected. Submit this information daily to the VA's representative.

2. The CPIH/CIH shall document and maintain the inspection and approval of the remediation area preparation prior to start of work and daily during work.

a. Removal of any poly barriers.

b. Packaging and removal of animal waste from remediation area.

c. Disposal of animal waste materials; copies of Waste Shipment Records/landfill receipts to the VA's representative on a weekly basis.

C. Submittals at Completion of Remediation: The CPIH/CIH shall submit a project report consisting of the daily logbook requirements and documentation of events during the remediation project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. The VA representative will retain the remediation report after completion of the project and provide copies of the remediation report to VAMC Office of Engineer and the Safety Office.

2.5 GERMICIDAL CLEANER

A. Performance Requirements:

1. Germicidal cleaners shall meet the latest requirements of EPA; and shall comply with the following performance requirements:

B. Certificates of Compliance: The Contractor shall submit to the VA representative certification from the manufacturer indicating compliance with performance requirements for encapsulants when applied according to manufacturer recommendations.

2.6 DISINFECTANTS

A. Performance Requirements:
   1. Disinfectants shall meet the latest requirements of EPA; and shall comply with the following performance requirements:

B. Certificates of Compliance: The Contractor shall submit to the VA representative certification from the manufacturer indicating compliance with performance requirements for encapsulants when applied according to manufacturer recommendations.

PART 3 - EXECUTION

3.1 REMDIATION AREA PREPARATIONS

A. Site Security:
   1. Remediation area access is to be restricted only to authorized, trained and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and representatives, State and Local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and be posted in the clean room of the decontamination unit.
   2. Entry into the remediation area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent Person shall immediately require any unauthorized person to leave the remediation area and then notify the VA Contracting Officer or VA Representative using the most expeditious means.
   3. A logbook shall be maintained in the clean room of the decontamination unit. Anyone who enters the remediation area must record their name, affiliation, time in, and time out for each entry.
   4. Access to the remediation area shall be through a single decontamination unit. All other access (doors, windows, hallways, etc.) shall be sealed and demarcated as a remediation work area to prevent entry to or exit from the remediation area unless in the event of an emergency. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized animal waste from the remediation area, and emergency exits. Emergency exits shall not be locked from the inside; however, they shall be sealed with poly sheeting and taped until needed. In any situation where exposure to high temperatures which may result in a flame hazard, fire retardant poly sheeting must be used.
   5. The Contractor's Competent Person shall control site security during remediation operations in order to isolate work in progress and protect adjacent personnel. A 24-hour security

system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.

6. The Contractor will have the VA's assistance in notifying adjacent personnel of the presence, location and quantity of animal waste in the regulated area and enforcement of restricted access by the VA's employees.
7. The regulated area shall be locked during non-working hours and secured by VA Representative or Competent Person. The VA Police shall be informed of remediation areas to provide security checks during facility rounds and emergency response.

B. Signage and Power Management:

1. Post OSHA BIOHAZARD signs meeting the specifications of OSHA 29 CFR 1910.145 at any location and approaches to the remediation area. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.
2. Shut down and lock out/tag out electric power to the remediation area. Provide temporary power and lighting. Ensure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.
3. Shut down and lock out/tag out heating, cooling, and air conditioning system (HVAC) components that are in, supply or pass through the remediation area. Investigate the remediation area and agree on pre-remediation condition with the VA's representative. Seal all intake and exhaust vents in the remediation area with duct tape and two (2) layers of independently installed 6-mil poly. Also, seal any seams in system components that pass through the remediation area. Remove all contaminated HVAC system filters and place in labeled 6-mil polyethylene disposal bags for staging and eventual disposal as animal waste.

C. Negative Pressure Filtration System:

1. The Contractor shall provide enough HEPA negative air machines to effect $\geq$ - 0.02-inch WCG pressure differential inside the remediation work area. The Competent Person shall determine the number of units needed for the remediation area by dividing the cubic feet in the remediation area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to effect $\geq$ - 0.02-inch WCG pressure inside the remediation work area. Provide standby units in the event of machine failure and/or emergency in an adjacent area. HEPA equipped negative air machines shall be discharged outside of the building a minimum of 30 feet from building make-up air, doors, open windows, patients, visitors and staff.
2. NIOSH has done extensive studies and has determined that negative air machines typically operate at ~50 percent efficiency. The contractor shall consider this in their determination of

number of units needed to provide ≥ - 0.02-inch WCG pressure differential inside the remediation work area. The contractor shall use double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2 inches pressure drop across the filters.

3. Design and Layout:
   a. Before start of work submit the design and layout of the remediation area and the negative air machines. The submittal shall indicate the number of, location of and size of negative air machines. The point(s) of exhaust, air flow within the remediation area, anticipated negative pressure differential, and supporting calculations for sizing shall be provided. In addition, submit the following:
      1)Method of supplying power to the units and designation/location of the panels.
      2)Description of testing method(s) for correct air volume and pressure differential.
      3)If auxiliary power supply is to be provided for the negative air machines, provide a schematic diagram of the power supply and manufacturer's data on the generator and switch.
4. Negative Air Machines (HEPA Units):
   a. Negative Air Machine Cabinet: The cabinet shall be constructed of steel or other durable material capable of withstanding potential damage from rough handling and transportation. The width of the cabinet shall be less than 30 inches in order to fit in standard doorways. The cabinet must be factory sealed to prevent fungal spores from being released during use, transport, or maintenance. Any access to and replacement of filters shall be from the inlet end. The unit must be on casters or wheels.
   b. Negative Air Machine Fan: The rating capacity of the fan must indicate the CFM under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan must be a centrifugal type fan.
   c. Negative Air Machine Final Filter: The final filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an airtight seal. Each HEPA filter shall be certified by the manufacturer to have an efficiency of not less than 99.97 percent. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter must bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.
   d. Negative Air Machine Pre-filters: The pre-filters, which protect the final HEPA filter by removing larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. A first stage pre-filter shall be a low efficiency

type for particles 10 µm or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5 µm or larger. Pre-filters shall be installed either on or in the intake opening of the negative air machine and the second stage filter must be held in place with a special housing or clamps.

e. Negative Air Machine Instrumentation: Each unit must be equipped with a gauge to measure the pressure drop across the filters and to indicate when filters have become loaded and need to be changed. A table indicating cubic feet per minute for various pressure readings on the gauge shall be affixed near the gauge for reference or the reading shall indicate at what point the filters shall be changed, noting cubic feet per minute delivery. The unit must have an elapsed time meter to show total hours of operation.

f. Negative Air Machine Safety and Warning Devices: An electrical/ mechanical lockout must be provided to prevent the fan from being operated without a HEPA filter. Units must be equipped with an automatic shutdown device to stop the fan in the event of a rupture in the HEPA filter or blockage in the discharge of the fan. Warning lights are required to indicate normal operation; too high a pressure drop across filters; or too low of a pressure drop across filters.

g. Negative Air Machine Electrical: All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriters Laboratories (UL). Each unit must be provided with overload protection and the motor, fan, fan housing, and cabinet must be grounded.

h. It is essential that replacement HEPA filters be tested using an “in-line” testing method, to ensure the seal around the periphery was not damaged during replacement. Damage to the outer HEPA filter seal could allow contaminated air to bypass the HEPA filter and be discharged to an inappropriate location. Contractor will provide written documentation of test results for negative air machine units with HEPA filters.

5. Pressure Differential: The fully operational negative air system within the remediation area shall continuously maintain a pressure differential $\geq$ - 0.02-inch WCG inside the remediation work area. Before any disturbance of any animal waste or animal waste-contaminated material, this shall be demonstrated to the VA by use of a pressure differential meter/manometer. The Competent Person shall be responsible for providing, maintaining, and documenting the negative pressure and air changes as required by OSHA and this specification.

6. Monitoring: The pressure differential shall be continuously monitored and recorded between the remediation area and the area outside the remediation area with a monitoring device that incorporates a strip chart recorder. The strip chart recorder shall become part of the project

log and shall indicate at least ≥ - 0.02-inch WCG pressure differential inside the remediation work area for the duration of the project.

7. Auxiliary Generator: If the building is occupied during remediation, provide an auxiliary gasoline/diesel generator located outside the building in an area protected from the weather. In the event of a power failure of the general power grid and the VAMC emergency power grid, the generator must automatically start and supply power to a minimum of 50 percent of the negative air machines in operation.
8. Supplemental Make-Up Air Inlets: Provide, as needed for proper air flow in the remediation area, in a location approved by the VA, openings in the plastic sheeting to allow outside air to flow into the remediation area. Auxiliary makeup air inlets must be located as far from the negative air machines as possible, off the floor near the ceiling, and away from the barriers that separate the remediation area from the occupied clean areas. Cover the inlets with weighted flaps which will seal in the event of failure of the negative pressure system.
9. Testing The System: The negative pressure system must be tested before any animal waste is disturbed in any way. After the remediation area has been completely prepared, the decontamination units set up, and the negative air machines installed, start the units up one at a time. Demonstrate and document the operation and testing of the negative pressure system to the VA using smoke tubes and a negative pressure gauge. Verification and documentation of adequate negative pressure differential across each barrier must be done at the start of each work shift.
10. Demonstration of the Negative Pressure Filtration System:
    a. The demonstration of the operation of the negative pressure system to the VA shall include, but not be limited to, the following:
        1)Plastic barriers and sheeting move lightly in toward the remediation area.
        2)Curtains of the decontamination units move in toward remediation area.
        3)There is a noticeable movement of air through the decontamination units. Use the smoke tube to demonstrate air movement from the clean room to the shower room to the equipment room to the remediation area.
        4)Use smoke tubes to demonstrate air is moving across all areas in which work is to be done. Use a differential pressure gauge to indicate a negative pressure of at > - 0.02 inch across every barrier separating the regulated area from the rest of the building. Modify the system as necessary to meet the above requirements.
11. Use of the Negative Pressure Filtration System During Remediation Operations:
    a. Start units before beginning any disturbance of animal waste occurs. After work begins, the units shall run continuously, maintaining four (4) actual air changes per hour at a negative pressure differential of > - 0.02-inch water column gauge, for the duration of the work until a final visual clearance has been successfully completed.

b. No negative air units shall be shut down at any time unless authorized by the VA Contracting Officer, verbally and in writing.

c. Pre-cleaning of animal waste contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of remediation in the work area.

d. Remediation work shall begin at a location farthest from the units and proceed towards them. If an electric failure occurs, the Competent Person shall stop all remediation work. Remediation work shall not resume until power is restored and all units are operating properly again.

e. The negative air machines shall continue to run after all work is completed and until a final visual clearance has been successfully completed for that remediation area.

12. Dismantling The System: After completion of the final visual and final air clearance has been obtained by the VPIH/CIH, the units may be shut down. The unit exterior surfaces shall have been completely decontaminated; pre-filters are not to be removed and the units inlet/outlet sealed with 2 layers of 6-mil poly immediately after shut down. No filter removal shall occur at the VA site following successful completion of site clearance. Applicable OSHA/EPA/DOT labels shall be attached to the units.

D. Containment Barriers and Coverings in the Remediation Area:

1. General: Seal off the perimeter to the Remediation area to completely isolate the remediation area from adjacent spaces. All surfaces in the remediation area must be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated as a result of the work, Contractor shall immediately stop work and clean up the contamination at no additional cost to the VA. Provide firestopping and identify all fire barrier penetrations due to remediation work as specified in Section 3.1.4.8; FIRESTOPPING.

2. Preparation Prior To Sealing: The Remediation Area: Place all tools, scaffolding, materials and equipment needed for working in the remediation area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the remediation area before commencing work. Any objects not scheduled for removal remaining in the remediation area shall be completely covered with 2 layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the remediation area.

3. Controlling Access to The Remediation Area: Access to the remediation area is allowed only through the personnel decontamination facility (PDF). All other means of access shall be eliminated, and OSHA BIOHAZARD demarcation signs posted as required by OSHA. If the remediation area is adjacent to, or within view of an occupied area, provide a visual barrier of 6-mil opaque fire-retardant poly to prevent building occupant observation. If the adjacent area

is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.

4. Critical Barriers: Completely separate any operations in the remediation area from adjacent areas using two (2) layers of 6-mil fire retardant poly and duct tape. Individually seal with two (2) layers of 6-mil poly and duct tape all HVAC openings into the remediation area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the remediation area. Heat must be shut off any objects covered with poly.
5. Primary Barriers:
   a. Cover the remediation area with two layers of 6-mil fire retardant poly on the floors and two layers of 4 mil, fire retardant poly on the walls, unless otherwise directed in writing by the VA representative. Floor layers must form a right angle with the wall and turn up the wall at least 300 mm (12 inches). Seams must overlap at least 1800 mm (6 feet) and must be spray glued and taped. Install sheeting so that layers can be removed independently from each other. Carpeting shall be covered with three layers of 6-mil poly. Corrugated cardboard sheets must be placed between the bottom and middle layers of poly. Mechanically support and seal with duct tape and glue all wall layers.
   b. If stairs and ramps are covered with 6-mil plastic, two (2) layers must be used. Provide 19 mm (3/4 inch) exterior grade plywood treads held in place with duct tape/glue on the plastic. Do not cover rungs or rails with any isolation materials.
6. Secondary Barriers: A loose layer of 6-mil shall be used as a drop cloth to protect the primary layers from debris generated during the remediation. This layer shall be replaced as needed during the work.
7. Extension of the Remediation Area: If the enclosure of the remediation area is breached in any way that could allow contamination to occur, the affected area shall be included in the remediation area and constructed as per this section. Decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.
8. Firestopping:
   a. Through penetrations caused by cables, cable trays, pipes, sleeves, conduits, etc. must be fire-stopped with a fire-rated firestop system providing an airtight seal.
   b. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether the location is fire rated. Any discovery of penetrations during remediation shall be brought to the attention of the VA representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.

c. Any visible openings regardless of cause shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed.

E. Sanitary Facilities: The Contractor shall provide sanitary facilities for remediation personnel and maintain them in a clean and sanitary condition throughout the remediation project.

F. Personal Protective Equipment: Provide whole body clothing, head coverings, gloves and foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

G. Pre-Cleaning:

1. The VA will provide water for remediation purposes. The Contractor shall connect to the existing VA system. The service to the shower(s) shall be supplied with backflow prevention.
2. Pre-cleaning of animal waste contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. All workers performing pre-cleaning activities must don appropriate personal protective equipment (PPE), as specified throughout this document and as approved in the Contractor's work plan. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of remediation in the work area.
3. Pre-clean all movable objects within the remediation area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the remediation area and carefully stored in an uncontaminated location. Drapes, clothing, upholstered furniture and other fabric items shall be disposed of as animal waste contaminated waste. Cleaning these animal waste contaminated items utilizing HEPA vacuum techniques, soap, and off-premises steam cleaning is very difficult and cannot guarantee decontamination. Carpeting will be disposed of prior to remediation if in the remediation area. If asbestos-containing material floor tile is attached to the carpet while the Contractor is removing the carpet that section of the carpet will be disposed of as asbestos waste as detailed in Section 02 82 13 19 ASBESTOS FLOOR TILE AND MASTIC ABATEMENT.
4. Pre-clean all fixed objects in the remediation area using HEPA filtered vacuums and/or wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult, but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with two (2) layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must

remain in the remediation area and that require special ventilation or enclosure requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.

5. Pre-clean all surfaces in the remediation area using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters.

H. Pre-Remediation Activities:

1. Pre-Remediation Meeting: The VA representative, upon receipt, review, and substantial approval of all pre-remediation submittals and verification by the CPIH/CIH that all materials and equipment required for the project are on the site, will arrange for a pre-remediation meeting between the Contractor, the CPIH/CIH, Competent Person(s), the VA representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/documentation to the VA's representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's representative will issue a written order to proceed to the Contractor. No remediation work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.

2. Pre-Remediation Construction and Operations:

   a. Perform all preparatory work for the first remediation area in accordance with the approved work schedule and with this specification.

   b. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's representative when the work is completed in accordance with this specification. The VA's representative may inspect the remediation area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AWHAP(s), especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for respiratory protection and the negative pressure system shall be demonstrated for proper performance.

   c. The CPIH/CIH shall document the pre-remediation activities described above and deliver a copy to the VA's representative.

   d. Upon satisfactory inspection of the installation of and operation of systems, the VA's representative will notify the Contractor in writing to proceed with the animal waste remediation work in accordance with this specification and all applicable regulations.

3. Pre-Remediation Inspections and Preparations:

a. Before any work begins on the construction of the remediation area, the Contractor will:

1)Conduct a space-by-space inspection with an authorized VA representative and prepare a written inventory of all existing damage in those spaces where animal waste remediation will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.

2)A NESHAP (destructive) ACM inspection shall be conducted on all building structures that will be demolished. Ensure the following areas are inspected on the project: lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside utility chases/walls; cementitious (transite™) piping/ductwork/sheets; behind radiators; lab fume hoods; cementitious (transite™) lab countertops; roofing materials; below window sills; water/sewer lines; electrical conduit coverings; crawlspaces (previous remediation contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; and steam line trench coverings. Verify during NESHAP survey that no other suspect ACM is present.

3)Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the remediation area have been cleaned and removed or properly protected from contamination.

4)If present and required, remove and dispose of carpeting from floors in the remediation area.

5)Inspect existing firestopping in the remediation area. Correct as needed.

3.2 REMOVAL OF ANIMAL WASTE

A. Wetting the affected area:

1. Use a disinfectant to wet down the remediation using an ultra-low volume fogger on a fine mist setting and then moving to course fog.
2. Contact spray a germicidal cleaner diluted to the manufacturer’s recommendations on any bulk animal waste to be remediated.
3. Use a shovel to lift animal waste into a double bagged heavy duty 3 mil plastic bag. Close and tie bag.

B. Secondary Barrier and Walkways:

1. Install as a drop cloth a 6-mil poly sheet at the beginning of each work shift where removal is to be done during that shift. Completely cover floors and any walls within 10 feet (3 meters) of the area where work is to done. Secure the secondary barrier with duct tape to prevent it from moving or debris from getting behind it. Remove the secondary barrier at the end of the shift or as work in the area is completed. Keep residue on the secondary barrier wetted. When removing, fold inward to prevent spillage and place in a disposal bag.

2. Install walkways using 6-mil black poly between the regulated area and the decontamination facilities (PDF and W/EDF) to protect the primary layers from contamination and damage. Install the walkways at the beginning of each shift and remove at the end of each shift.

3.3 DISPOSAL OF ANIMAL WASTE MATERIALS

A. General: Dispose of animal waste and debris which is packaged in accordance with these specifications, in accordance with OSHA, EPA, State, Local and DOT requirements. The landfill requirements for packaging must also be met. Transport will comply 49 CFR 171-180 regulations. Disposal shall be done at an approved landfill.

B. Procedures:

1. The VA must be notified at least 24 hours in advance of any waste removed from the containment.
2. Animal waste shall be packaged and moved through the W/EDF into a covered transport container in accordance with procedures is this specification. Waste shall be double-bagged prior to disposal. Wetted waste can be very heavy. Bags shall not be overfilled. Bags shall be evacuated with HEPA vacuum and securely sealed to prevent accidental opening and/or leakage. The top shall be tightly twisted and goose necked prior to tightly sealing with at least three wraps of duct tape. Ensure that unauthorized persons do not have access to the waste material once it is outside the regulated area. All transport containers must be securely closed when not in use. Animal waste shall be transported in a rigid, non-porous, and readily decontaminated container labeled with a biohazard system. The container must contain absorbent materials to prevent leaks or spills. The container must have a secure lid. The outer container must be clearly labeled with the biohazard symbol.
3. Waste Load Out: Waste load out shall be done in accordance with the procedures in W/EDF Decontamination Procedures. Sealed waste bags shall be decontaminated on exterior surfaces by wet cleaning and HEPA vacuuming before being placed in the second waste bag and sealed, which then must also be wet wiped, and HEPA vacuumed.

3.4 PROJECT DECONTAMINATION

A. General:

1. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.
2. If the animal waste remediation work is in an area which was contaminated prior to the start of remediation, the decontamination will be done by cleaning the primary barrier poly prior to its removal and cleanings of the surfaces of the remediation area after the primary barrier removal.

B. Remediation Area Clearance: Visual clearance inspection and other requirements which must be met before release of the Contractor and re-occupancy of the remediation area space are specified in Final Inspection Procedures.

C. Work Description: Decontamination includes decontamination and removal of the enclosures/facilities installed prior to the remediation work including primary/critical barriers, PDF and W/EDF facilities, and negative pressure systems.

D. Pre-Decontamination Conditions:

1. Before decontamination starts, all animal waste from the remediation area shall be collected and removed, and the loose 6-mil layer of poly removed while being adequately wetted with amended water and disposed of along with any gross debris generated by the work.
2. At the start of decontamination, the following shall be in place:
   a. Primary barriers consisting of two (2) layers of 6-mil poly on the floor and 4 mil poly on the walls.
   b. Critical barriers consisting of two (2) layers of 6-mil poly which is the sole barrier between the regulated area and openings to the rest of the building or outside.
   c. Decontamination facilities for personnel and equipment in operating condition and the negative pressure system in operation.

E. First Cleaning: Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and HEPA vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as animal waste in accordance with these specifications. The negative pressure system shall remain in operation during this time. Additional cleaning(s) may be needed as determined by the CPIH/VPIH/CIH.

3.5 FINAL VISUAL INSPECTION

A. General: Notify the VA representative 24 hours in advance for the performance of the final visual inspection. The final visual inspection will be performed by the VPIH/CIH starting after the final cleaning. Final Visual Inspection: Final visual inspection will include the entire remediation area, the PDF, all poly sheeting, seals over HVAC openings, doorways, windows, and any other openings. If any debris, residue, dust or any other suspect material is detected, the final cleaning shall be repeated at no additional cost to the VA. Dust/material samples may be collected and analyzed at no additional cost to the VA at the discretion of the VPIH/CIH to confirm visual findings. If release criteria are met, proceed to perform the remediation closeout and to issue the certificate of completion in accordance with these specifications.

3.6 REMEDIATION CLOSEOUT AND CERTIFICATE OF COMPLIANCE

A. Completion of Remediation Work:

1. After thorough decontamination, seal negative air machines with 2 layers of 6-mil poly and duct tape to form a tight seal at the intake/outlet ends before removal from the remediation area. Complete animal waste remediation work upon meeting the remediation area visual clearance criteria and fulfilling the following:
    a. Remove all equipment and materials from the project area.
    b. Dispose of all packaged animal waste as required.
    c. Repair or replace all interior finishes damaged during the remediation work, as required.
    d. Fulfill other project closeout requirements as required in this specification.

B. Certificate of Completion By Contractor: The CPIH/CIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the remediation and decontamination of the remediation area.

C. Work Shifts: All work shall generally be done during administrative hours (8:00 AM to 4:30 PM) Monday - Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative.

ATTACHMENT #1
CERTIFICATE OF COMPLETION

DATE: _____ VA Project #:_____

PROJECT NAME:_____ Remediation Contractor:_____

VAMC/ADDRESS:_____

1. I certify that I have personally inspected, monitored and supervised the remediation work of (specify remediation area or Building):
   which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the remediation area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Remediation Contractor engaged in this work were trained in respiratory protection, were experienced with remediation work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to animal waste without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the remediation area were always maintained in a safe and healthy condition, except as described below.
7. That all remediation work was done in accordance with OSHA requirements and the manufacturer’s recommendations.

CPIH/CIH Signature/Date:_____

CPIH/CIH Print Name:_____

Remediation Contractor Signature/Date:_____

Remediation Contractor Print Name:_____

ATTACHMENT #2
CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME:_____DATE:_____

PROJECT ADDRESS:_____

REMEDIATION CONTRACTOR'S NAME:_____

WORKING WITH ANIMAL WASTE CAN BE HAZARDOUS TO YOUR HEALTH. INHALING FUNGAL SPORES FROM ANIMAL WASTE HAS BEEN INLINKED WITH HISTOPLASMOSIS.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an animal waste remediation project. You must receive/have a current medical approval for wearing a respirator which is required when working with animal waste. These things shall be provided at no cost to you. By signing this certificate of worker’s acknowledgement you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by my employer in the means and methods of animal waste remediation.

MEDICAL QUESTIONAIRE: I have completed a medical questionnaire for the wearing of a respirator within the past 12 months. This questionnaire was reviewed the licensed healthcare practitioner, or other medical professional as allowed by State law. The physician issued a positive written opinion after the examination.

Signature:_____

Printed Name:_____

Social Security Number(Last Four):_____

Witness:_____

ATTACHMENT #3
AFFIDAVIT OF MEDICAL QUESTIONAIRE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER:_____

VA MEDICAL FACILITY:_____

REMEDIATION CONTRACTOR'S NAME AND ADDRESS:_____

1. I verify that the following individual

Name:_____ Social Security Number (Last Four):_____

who is proposed to be employed in animal waste remediation work associated with the above project by the named Remediation Contractor, has completed a medical questionnaire for the use a respirator, and that questionnaire has been reviewed by a licensed healthcare practitioner, or other medical professional as required by state law, and that complete records of the questionnaire by 29 CFR 1910.20, and 29 CFR1910.440 are kept at the offices of the Remediation Contractor at the following address.

Address:_____

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained to perform animal waste remediation.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH:_____ Date:_____

Printed Name of CPIH/CIH:_____

Signature of Contractor:_____ Date:_____

Printed Name of Contractor:_____

ATTACHMENT #4
REMEDIATION CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ANIMAL WASTE SPECIFICATIONS

VA Project Location:_____

VA Project #:_____

VA Project Description:_____

1. This form shall be signed by the Animal Waste Remediation Contractor Owner and the Animal Waste Remediation Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Animal Waste Remediation Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

2 I, the undersigned, have read VA's Animal Waste Specification regarding the animal waste remediation requirements. I understand the requirements of the VA's Animal Waste Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Animal Waste Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Animal Waste Specification.

3. At the conclusion of the animal waste remediation, I will certify that all animal waste remediation work was done in accordance with the VA's Animal Waste Specification and all animal waste was removed properly and no residue remains on any remediation surfaces.

Remediation Contractor Owner's Signature_____Date_____

- - - E N D - - -

https://www.jondon.com/how-to/technical-tips/animal-insect-infestation/bat-guano.html

https://www.mass.gov/doc/remediation-of-bird-waste-inside-buildings-0/download

SECTION 03 30 53
(SHORT FORM) CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place structural concrete.
2. Slab on grade infill.
3. Suspended slab infill on metal deck.
4. Foundation wall infill.
5. Footings.
6. Equipment pads.
7. Preparation of existing surfaces to receive concrete.
8. Preparation of existing surface to received concrete topping.

1.2 RELATED WORK

A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials Testing and Inspection During Construction.

B. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS

C. Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS: Concrete Roads, Walks, and Similar Exterior Site Work.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this Section.

B. American Concrete Institute (ACI):

117-10(R2015) ..... Specification for Tolerances for Concrete Construction and Materials and Commentary

211.1-91(R2009) ..... Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

301/301M-16 ..... Specifications for Structural Concrete.

305.1-14 - ..... Hot Weather Concreting.

306.1-90(R2002) ..... Cold Weather Concreting.

318/318M-19 ..... Building Code Requirements for Structural Concrete and Commentary

347R-14 - ..... Guide to Formwork for Concrete.

SP-66-04- ..... ACI Detailing Manual.

C. ASTM International(ASTM):

A615/A615M-20 ..... Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A996/A996M-16 ..... Standard Specification for Rail Steel and Axle Steel Deformed Bars for Concrete Reinforcement

A1064/A1064M-18a ..... Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C33/C33M-18 ..... Standard Specification for Concrete Aggregates.

C39/C39M-20 ..... Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C94/C94M-20 ..... Standard Specification for Ready-Mixed Concrete.

C143/C143M-20 ..... Standard Test Method for Slump of Hydraulic Cement Concrete.

C150/C150M-20 ..... Standard Specification for Portland Cement.

C171-16 ..... Standard Specification for Sheet Materials for Curing Concrete.

C192/C192M-19 ..... Standard practice for Making and Curing Concrete Test Specimens in the Laboratory.

C219-20a ..... Standard Terminology Relating to Hydraulic and Other Inorganic Cements.

C260/C260M-10a(2016) ..... Standard Specification for Air-Entraining Admixtures for Concrete.

C494/C494M-19 ..... Standard Specification for Chemical Admixtures for Concrete.

C618-19 ..... Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

C881/C881M-20 ..... Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

C989/C989M-18a ..... Standard Specification for Slag Cement for Use in Concrete and Mortars.

C1240-20 ..... Standard Specification for Silica Fume Used in Cementitious Mixtures.

D1751-18 ..... Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

E1155-20 ..... Determining FF Floor Flatness and FL Floor Levelness Numbers.

E1745-17 ..... Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

D. International Concrete Repair Institute:

310.2R-2013 - ..... Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.4 SUBMITTALS

A. Submittal Procedures: Refer to Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.

B. Submittal Drawings:

1. Submit large scale drawings of reinforcing steel, including all reinforcing bend diagrams and reinforcing details, to the COR for review and approval.

C. Manufacturer's Literature and Data:

1. Concrete Mix Design.
2. Air-entraining admixture, chemical admixtures, and curing compounds.
3. Indicate manufacturer's recommendation for each application.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Certificates: Certify products comply with specifications.

1. Each ready mix concrete batch delivered to site.

1.5 DELIVERY

A. Deliver each ready-mixed concrete batch with mix certification in duplicate according to ASTM International(ASTM) C94/C94M.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: as indicated on Structural Drawings.

B. Pozzolans:

1. Fly Ash: ASTM International(ASTM) C618, Class C or F including supplementary optional physical requirements. Pozzolans shall not exceed 25 percent of total cementitious materials by weight.
2. Slag: ASTM International(ASTM) C989/C989M; Grade 80, Grade 100 or Grade 120.
3. Silica Fume: ASTM International(ASTM) C1240.

C. Coarse Aggregate: ASTM International(ASTM) C33/C33M.

1. Size 467 for footings and walls over 300 mm (12 inches) thick.
2. Size 7 for coarse aggregate for applied topping and metal pan stair fill.
3. Size 67 for other applications.

D. Fine Aggregate: ASTM International(ASTM) C33/C33M.

E. Mixing Water: as indicated on Structural Drawings.

F. Air-Entraining Admixture: ASTM International(ASTM) C260/C260M.

G. Chemical Admixtures: ASTM International(ASTM) C494/C494M.

H. Vapor Barrier: ASTM International(ASTM) E1745, Class A with a minimum puncture resistance of 2200 g (3000 pounds); minimum 0.38 mm (15 mil) thick.

I. Reinforcing Steel: as indicated on Structural Drawings.

J. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer, 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.
3. Form coating: As recommended by Contractor.

K. Welded Wire Fabric: as indicated on Structural Drawings.

L. Expansion Joint Filler: ASTM International(ASTM) D1751.

M. Sheet Materials for Curing Concrete: ASTM International(ASTM) C171.

N. Abrasive Aggregates: Aluminum oxide grains or emery grits.

O. Liquid Densifier/Sealer: 100 percent active colorless aqueous siliconate solution.

P. Grout, Non-Shrinking: Premixed ferrous or non-ferrous. Grout to show no settlement or vertical drying shrinkage at 3 days. Compressive strength for grout, at least 18 MPa (2500 psi) at 3 days and 35 MPa (5000 psi) at 28 days.

2.2 ACCESSORIES

A. Bonding Agent: ASTM International (ASTM) C 1059/C 1059M, Type II.

B. Structural Adhesive: ASTM International (ASTM) C881, 2-component material suitable for use on dry or damp surfaces. Provide material Type, Grade, and Class to suit Project requirements.

C. Water Stops: Rubber base with self-healing properties. Expanding clay based products not acceptable.

D. Weeps: Geotextile type as recommended by Contractor and approved by the COR.

2.3 CONCRETE MIXES

A. Design concrete mixes according to ASTM International (ASTM) C94/C94M, Option C.

B. Compressive strength at 28 days: as indicated on Structural Drawings.

C. Submit mix design and results of compression tests to the Contracting Officer for his evaluation. Identify all materials, including admixtures, making-up the concrete.

D. Maximum Slump for Vibrated Concrete: 100 mm (4 inches) tested according to ASTM International (ASTM) C143.

E. Cement and Water Factor: as indicated on Structural Drawings.

F. Air-entrainment: as indicated on Structural Drawings.

2.4 BATCHING AND MIXING

A. Store, batch, and mix materials according to ASTM C94/C94M.

1. Job-Mixed: not permitted.

2. Ready-Mixed Concrete: Comply with ASTM International(ASTM)C94/C94M, except use of non-agitating equipment for transporting concrete to Site is not acceptable.
3. When aggregate producer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

PART 3 - EXECUTION

3.1 FORMWORK

A. Installation: Conform to ACI 347. Construct forms to obtain concrete of the shapes, dimensions and profiles indicated, with tight joints.
B. Design and construct forms to prevent bowing-out of forms between supports and to be removable without prying against or otherwise damaging fresh concrete.
C. When patching formed concrete, seal form edges against existing surface to prevent leakage; set forms so that patch is flush with adjacent surfaces.
D. Treating and Wetting: Treat or wet concrete contact surfaces:
   1. Coat plywood and lumber forms with non-staining form sealer.
   2. Wet wood forms thoroughly when they are not treated with form release agent.
   3. Prevent water from accumulating and remaining within forms.
   4. Clean and coat removable metal forms with light form oil before reinforcement is placed.
   5. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
   6. Prevent water from accumulating and remaining within forms.
E. Inserts, Sleeves, and Similar Items: Install flashing reglets, masonry ties, anchors, inserts, wires, hangers, sleeves, boxes for floor hinges, and other cast-in items specified in other Sections. Place where indicated, square, flush and secured to formwork.
F. Construction Tolerances - General: Install and maintain concrete formwork to assure completion of work within specified tolerances.
G. Adjust or replace completed work exceeding specified tolerances before placing concrete.

3.2 REINFORCEMENT

A. Install concrete reinforcement according to ACI 318 and ACI SP-66.
B. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.
C. Drilling for Dowels in Existing Concrete: Use sharp bits, drill hole slightly oversize, fill with epoxy grout, inset the dowel, and remove excess epoxy.

3.3 VAPOR BARRIER

A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier.
B. Lap joints 150 mm (6 inches) and seal with a compatible pressure-sensitive tape.
C. Patch punctures and tears.

3.4 PLACING CONCRETE

A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval from Contracting Officer's Representative before placing concrete.

B. Install screeds at required elevations for concrete slabs.

C. Roughen and clean free from laitance, foreign matter, and loose particles before placing new concrete on existing concrete.

1. Blow-out areas with compressed air and immediately coat contact areas with adhesive in compliance with manufacturer's instructions.

D. Place structural concrete according to ACI 301 and ACI 318.

E. Convey concrete from mixer to final place of deposit by method that will prevent segregation or loss of ingredients. Do not deposit, in Work, concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work.

F. Place and consolidate concrete in horizontal layers not exceeding 300 mm (12 inches) in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Continuously vibrate during placement of concrete.

G. Concrete Fill in Stair Tread and Landing Pans: Coat steel with bonding agent and fill pans with concrete. Reinforce with 2 inch by 2 inch by 1.6 mm (0.06 inch) welded wire mesh at midpoint.

H. Hot Weather Concrete Placement: As recommended by ACI 305.1 to prevent adversely affecting properties and serviceability of hardened concrete.

I. Cold Weather Concrete Placement: As recommended by ACI 306.1, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly.

1. Do not use calcium chloride without written approval from Contracting Officer's Representative.

3.5 TOLERANCES

A. Slab on Grade Finish Tolerance: Comply with ACI 117, FF-number and FL-number method.

1. Paragraph 4.8.3, Class A 3 mm (1/8 inches) for offset in form-work.
2. Table R4.8.4, "Flat" 6 mm (1/4 inch) in 3 m (10 feet) for slabs.

3.6 PROTECTION AND CURING

A. Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical damage, and excessive hot or cold temperatures.

B. Curing Methods: Cure concrete with curing compound using wet method with sheets.

C. Formed Concrete Curing: Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.

1. If forms are removed before 14 days after concrete is cast, install sheet curing materials as specified above.

D. Concrete Flatwork Curing:
   1. Install sheet materials according to the manufacturer's instructions.
      a. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.7 FORM REMOVAL

A. Maintain forms in place until concrete is self-supporting, with construction operation loads.
B. Remove fins, laitance and loose material from concrete surfaces when forms are removed. Repair honeycombs, rock pockets, sand runs, spalls, or otherwise damaged surfaces by patching with the same mix as concrete minus the coarse aggregates.
C. Finish to match adjacent surfaces.

3.8 FINISHES

A. Vertical and Overhead Surface Finishes:
   1. Surfaces Concealed in Completed Construction: As-cast; no additional finishing required.
   2. Surfaces Exposed in Unfinished Areas: As-cast; no additional finishing required.
      a. Mechanical rooms.
      b. Electrical rooms.
      c. Elevator machine rooms.
   3. Surfaces Exposed to View Scheduled for Paint Finish: Remove fins, burrs and similar projections by mechanical means approved by Contracting Officer's Representative flush with adjacent surface. Lightly rub with fine abrasive stone or hone. Use ample amount of water during rubbing without working up a lather of mortar or changing texture of concrete.
   4. Surfaces Exposed to View in Finished Areas: Grout finish, unless otherwise shown, for uniform color and smooth finish treated.
      a. Remove laitance, fins and burrs.
      b. Scrub concrete with wire brushes. Clean stained concrete surfaces with hone or stone.
      c. Apply grout composed of 1 part Portland cement and 1 part clean, fine sand (smaller than 600 micro-m (No. 30) sieve). Work grout into surface of concrete with cork floats or fiber brushes until pits and honeycomb are filled.
      d. After grout has hardened, but is still plastic, remove surplus grout with sponge rubber float and by rubbing with clean burlap.
      e. In hot, dry weather fog spray surfaces with water to keep grout wet during setting period. Complete finished areas in same day. Confine limits of finished areas to natural breaks in wall surface. Do not leave grout on concrete surface overnight.
B. Slab Finishes:
   1. Allow bleed water to evaporate before surface is finished. Do not sprinkle dry cement on surface to absorb water.

2. Scratch Finish: Rake or wire broom after partial setting slab surfaces to received bonded applied cementitious application, within 2 hours after placing, to roughen surface and provide permanent bond between base slab and applied cementitious materials.
3. Float Finish: Interior and exterior ramps, interior stair treads, and platforms, both equipment pads, and slabs to receive non-cementitious materials, except as specified.
   a. Screen and float to smooth dense finish.
   b. After first floating, while surface is still soft, check surfaces for alignment using straightedge or template. Correct high spots by cutting down with trowel or similar tool. Correct low spots by filling in with material same composition as floor finish. Remove any surface projections on floated finish by rubbing or dry grinding. Refloat slab to uniform sandy texture.
4. Steel Trowel Finish: Applied toppings, concrete surfaces to receive resilient floor covering or carpet, future floor roof and other monolithic concrete floor slabs exposed to view without other finish indicated or specified.
   a. Delay final steel troweling to secure smooth, dense surface, usually when surface can no longer be dented by fingers. During final troweling, tilt steel trowel at slight angle and exert heavy pressure on trowel to compact cement paste and form dense, smooth surface.
   b. Finished surface: Free from trowel marks. Uniform in texture and appearance.
5. Broom Finish: Finish exterior slabs, ramps, and stair treads with bristle brush moistened with clear water after surfaces have been floated.
6. Finished Slab Flatness (FF) and Levelness (FL):
   a. Slab on Grade: Specified overall value FF 25/FL 20. Minimum local value FF 17/FL 15.
   b. Test flatness and levelness according to ASTM E1155.

3.9 SURFACE TREATMENTS

A. Mix and apply the following surface treatments according to manufacturer's instructions.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
B. Liquid Densifier/Sealer: Use for exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.
C. Slip Resistant Finish:
   1. Except where safety nosing and tread coverings are shown, apply abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms.
      a. Broadcast aggregate uniformly over concrete surface. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water sufficiently to slightly expose abrasive aggregate.

3.10 FOUNDATION WALL INFILL

A. Install air-entrained concrete at foundation wall infill, as indicated.

B. Install expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves, as indicated.

C. Finish exposed surfaces to match adjacent concrete surfaces, new or existing.

D. Place porous backfill, as indicated on Drawings.

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SECTION 04 01 00
MAINTENANCE OF MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Repointing existing damaged masonry joints.

1.2 RELATED WORK

A. Section 04 05 13, MASONRY MORTARING: Mortars for new masonry.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

C67/C67M-20.....Sampling and Testing Brick and Structural Clay Tile.

C144-18 .....Aggregate for Masonry Mortar.

C150/C150M-20.....Specification for Portland Cement.

C207-18 - .....Hydrated Lime for Masonry Purposes

C216-19 - .....Facing Brick (Solid Masonry Units Made from Clay or Shale)

C270-19ae1 .....Mortar for Unit Masonry

C295/C295M-19.....Petrographic Examination of Aggregates for Concrete

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Replacement units indicating manufacturer recommendation for each application.

C. Samples:

1. Pointing Mortar: Molded, 150 mm (6 inches) long for each type, texture, and color.

D. Test reports:

1. Preconstruction test results of existing masonry mortar and units.
2. Recommended mortar mix and mortar materials sources.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Documented experience in completion of work, similar in design, material, and extent specified.

B. Preconstruction Testing:

1. Existing Brick: according to ASTM C67.
2. Existing Mortar: according to ASTM C295/C295M.
   a. Recommend mortar mix compatible with existing material sources required to match existing color and texture.

C. Mockups: Prepare mockup in size indicated on Drawings, demonstrating quality and aesthetics of tuck pointing and cleaning.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store materials covered, protected from weather, and elevated above grade.

1. Prevent contamination of aggregates.

B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment:

1. Cold Weather Requirements: Maintain mortar ingredients and substrate within temperature range between 4 degrees C (40 degrees F) and 49 degrees C (120 degrees F) when outside temperature is less than 4 degrees C (40 degrees F).
2. Hot Weather Requirements: Protect mortar-joint from evaporation of moisture from mortar material. When required, provide adequately shaded work area.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mortar Components:

1. Hydrated Lime: ASTM C207, Type S.
2. Aggregate: ASTM C144.
3. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.

2.3 MIXES

A. Tuck Pointing Mortar: ASTM C270

1. Type N.

2.4 ACCESSORIES

A. Cleaning Agent: Soapless, non-acidic, detergent, specially prepared for cleaning brick and stone.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

1. Protect from mortar droppings and cleaning operations.

C. Remove existing fixtures and fittings concealing masonry joints to permit repointing and repair.

3.2 EXISTING MORTAR JOINTS

A. Cut out existing bed and head mortar joints, to uniform depth of 19 mm (3/4 inches), or to sound mortar without damaging edges and faces of existing masonry units to remain.

B. Remove dust and debris from joints.

1. Do not rinse when temperature is below freezing.

3.3 TUCK POINTING

A. Dampen joints immediately before tuck pointing. Allow masonry units to absorb surface water.

B. Tightly pack tuck pointing mortar into joints in thin layers, 6 mm (1/4 inch) thick, maximum.

C. Allow layer to become slightly hardened before applying next layer.

D. Pack final layer flush with surfaces of masonry units.

3.4 JOINT TOOLING

A. Tool repointed joints when mortar becomes slightly hardened.

B. Produce smooth, compacted, joint matching existing.

3.5 CLEANING

A. Remove mortar splatter from exposed surfaces immediately.

B. Clean exposed masonry surfaces on completion, starting at the bottom of the wall and working upwards.

C. Remove mortar droppings and other foreign substances from wall surfaces.

D. Wet surfaces with clean, low-pressure water, at no greater pressure than 350 psi

1. Do not rinse when temperature is below freezing.

E. Wash with cleaning agent.

F. Brush masonry surfaces with stiff fiber brushes while washing.

G. Immediately after washing, rinse with clean water.

1. Remove traces of detergent, foreign streaks or stains.

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SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry mortar installed by other concrete and masonry sections.

1.2 RELATED REQUIREMENTS

A. Mortar used in Section:

1. Section 04 01 00, MAINTENANCE OF MASONRY.
2. Section 04 05 16, MASONRY GROUTING.
3. Section 04 20 00, UNIT MASONRY.

B. Mortar Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

1. C40/C40M-11 - Organic Impurities in Fine Aggregates for Concrete.
2. C91/C91M-12 - Masonry Cement.
3. C144-11 -Aggregate for Masonry Mortar.
4. C150/C150M-15 - Portland Cement.
5. C207-06(2011) - Hydrated Lime for Masonry Purposes.
6. C270-14a - Mortar of Unit Masonry.
7. C595/C595M-15e1 - Blended Hydraulic Cements.
8. C780-15 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
9. C979/C979M-10 - Pigments for Integrally Colored Concrete.
10. C1329/C1329M-15 - Mortar Cement.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Test Reports: Certify each product complies with specifications.

1. Mortar.
2. Admixtures.

D. Certificates: Certify each product complies with specifications.

1. Portland cement.
2. Masonry cement.

3. Mortar cement.
4. Hydrated lime.
5. Fine aggregate.
6. Color admixture.

E. Qualifications: Substantiate qualifications comply with specifications.
1. Testing laboratory.

1.5 QUALITY ASSURANCE

A. Preconstruction Testing:
1. Engage independent testing laboratory to tests and submit reports.
a. Deliver samples to laboratory in number and quantity required for testing.
2. Test mortar and materials specified.
3. Mortar:
a. Test for compressive strength and water retention according to ASTM C270.
b. Minimum Mortar compressive strengths 28 days:
1) Type M: 17.2 MPa (2,500 psi).
2) Type S: 12.4 MPa (1,800 psi).
3) Type N: 5.1 MPa (750 psi).
4. Non-Staining Cement: Test for water soluble alkali.
a. Water Soluble Alkali: Maximum 0.03 percent.
5. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, // color, // production run number, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store masonry materials under waterproof covers on planking clear of ground.
1. Protect loose, bulk materials from contamination.
B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hydrated Lime: ASTM C207, Type S.
B. Aggregate for Masonry Mortar: ASTM C144 and as follows:

1. Light colored sand for mortar for laying face brick.
2. White plastering sand meeting sieve analysis for mortar joints for pointing except that 100 percent passes No. 8 sieve, and maximum 5 percent retained on No. 16 sieve.
3. Test sand for color value according to ASTM C40/C40M. Sand producing color darker than specified standard is unacceptable.

C. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, IP.

D. Masonry Cement: ASTM C91/C91M. Type N, S, Or M.

1. Use white masonry cement whenever white mortar is specified.

E. Mortar Cement: ASTM C1329/C1329M, Type N, S or M.

F. Portland Cement: ASTM C150/C150M, Type I.

1. Use white Portland cement wherever white mortar is specified.

G. Pigments: ASTM C979/C979M; inorganic, inert, mineral pigments only, unaffected by atmospheric conditions, nonfading, alkali resistant, and water insoluble.

H. Water: Potable, free of substances that are detrimental to mortar, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.

2.3 MIXES

A. Pointing Mortar for New Work:

1. For Cast Stone or Precast Concrete: Proportion by volume; one part white Portland cement, two parts white sand, and 1/5 part hydrated lime.
2. Pointing Mortar for Glazed Structural Facing Tile:
   a. Proportion by volume: One part white Portland cement, two parts of graded white sand passing Number 50 sieve, and 1/8 part hydrated lime.

B. Tuck Pointing Mortar for Repair Work: Tuck pointing mortar specified in Section 04 01 00, MAINTENANCE OF MASONRY.

C. Masonry Mortar: ASTM C270.

1. Admixtures:
   a. Do not use mortar admixtures, and color admixtures unless approved by Contracting Officer's Representative.
   b. Do not use antifreeze compounds.

D. Colored Mortar:

1. Maintain uniform mortar color for exposed work, throughout.
2. Match mortar color in approved sample or sample panel specified in Section 04 20 00, UNIT MASONRY.
3. Alteration Work Mortar Color: Match existing mortar unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.

E. Color Admixtures:
   1. Proportion as specified by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
B. Protect existing construction and completed work from damage.

3.2 MIXING

A. Measure ingredients by volume using known capacity container.
B. Mix for 3 to 5 minutes in a mechanically operated mortar mixer.
C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
D. Mortar Stiffened Because of Water Loss Through Evaporation:
   1. Re-temper by adding water to restore to proper consistency and workability.
   2. Discard mortar reaching initial set or unused within two hours of mixing.
E. Pointing Mortar:
   1. Mix dry ingredients with enough water to produce damp mixture of workable consistency retaining shape when formed into ball.
   2. Allow mortar to stand in dampened condition for 60 to 90 minutes.
   3. Add water to bring mortar to a workable consistency before use.

3.3 MORTARING

A. Type M Mortar: Use for parging below grade.
B. Type S Mortar: Use for masonry containing vertical reinforcing bars (non-engineered), masonry below grade and engineered reinforced unit masonry work.
C. Type N Mortar: Use for other masonry work.
D. Type N Mortar: Use for pointing items and tuck pointing specified.

3.4 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
   1. Take and test samples during progress of work according to ASTM C780.

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SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grout for filling hollow concrete masonry cores.

1.2 RELATED WORK

A. Section 04 20 00, UNIT MASONRY: Grout

B. Section 09 06 00, SCHEDULE FOR FINISHES: Grout Color

C. Section 09 30 13, CERAMIC/PORCELAIN TILING: Ready-Mixed Grout.

D. Section 09 91 00, PAINTING

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section

American National Standards Institute (ANSI):

A118.6-19 - .....Standard Cement Grouts for Tile Installation.

B. ASTM International (ASTM):

C40/C40M-20 - .....Organic Impurities in Fine Aggregates for Concrete.

C150/C150M-20 - .....Portland Cement.

C207-18 - .....Hydrated Lime for Masonry Purposes.

C404-18 - .....Aggregates for Masonry Grout.

C476-20 - .....Grout for Masonry.

C595/C595M-20 - .....Blended Hydraulic Cement.

C979/C979M-16 - .....Pigments for Integrally Colored Concrete.

C1019-19 - .....Sampling and Testing Grout.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer’s Representative (COR) review and approval.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Sustainable Construction Submittals:

1. Recycled Content: Identify pre-consumer recycled content percentage by weight.

D. Test Reports: Certify each product complies with specifications.

1. Grout, each type.
2. Cement.
3. Aggregate.

E. Certificates: Certify each product complies with specifications.

1. Blended hydraulic cement.
2. Portland cement.

3. Grout.
4. Hydrated lime.
5. Aggregate.
6. Color admixture.

1.5 QUALITY ASSURANCE

A. 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. Grout:
a. Test compressive strength according to ASTM C1019 standard.
3. Cement:
a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
b. Nonstaining cement containing more than 0.03 percent water soluble alkali.
4. Aggregate:
a. Test for deleterious substances, organic impurities, soundness and grading.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

1.7 STORAGE AND HANDLING

A. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.
B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grout Components:
1. Hydrated Lime: ASTM C207, Type S.
2. Aggregate For Masonry Grout: ASTM C404, Size 8.
3. Blended Hydraulic Cement: ASTM C595, Type IS, IP.
4. Portland Cement: ASTM C150, Type I.
5. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.
B. Sustainable Construction Requirements:

1. Blended Hydraulic Cement Recycled Content: Select products with recycled content to achieve overall Project recycled content requirement.

2.3 MIXES

A. Grout: ASTM C476; fine grout and coarse grout.
   1. Color Admixture:
      a. Pigments: ASTM C979, inert, stable to atmospheric conditions, nonfading, alkali resistant, and water insoluble.
      b. Use mineral pigments only. Organic pigments are not acceptable.

B. Ready-Mixed Grout: ANSI A118.8.

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. Clean mortar from masonry cells protruding more than 13 mm (1/2 inch) to permit grout flow.

D. Remove debris from grout spaces.

E. Verify reinforcement is correctly placed before placing grout.

3.2 MIXING

A. Mix grout in mechanically operated mixer.
   1. Mix grout for five minutes, minimum.

B. Measure ingredients by volume using container of known capacity.

C. Mix water with grout dry ingredients.
   1. Slump Range: 200 to 275 mm (8 to 11 inches).

3.3 GROUTING

A. Install grout according to Section 04 20 00, UNIT MASONRY.

B. Use fine grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is 50 mm (2 inches) or less.

C. Use either fine grout or coarse grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is greater than 50 mm (2 inches).

D. Use grout for filling bond beam or lintel units.

- - E N D - -

SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete masonry unit (CMU) assemblies for:

1. Exterior walls.

1.2 RELATED REQUIREMENTS

A. Sealants and Sealant Installation: Section 07 92 00, JOINT SEALANTS.

1.3 APPLICABLE PUBLICATIONS

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

B. American Concrete Institute (ACI):

1. 315-99 - Details and Detailing of Concrete Reinforcement.
2. 530.1/ASCE 6/TMS 602-13 - Specification for Masonry Structures.

C. ASTM International (ASTM):

1. A615/A615M-15ae1 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. A951/A951M-14 - Steel Wire for Masonry Joint Reinforcement.
3. A1064/A1064M-15 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
4. C55-14a - Concrete Building Brick.
5. C62-13a - Building Brick (Solid Masonry Units Made from Clay or Shale).
6. C67-14 - Sampling and Testing Brick and Structural Clay Tile.
7. C90-14 - Load-Bearing Concrete Masonry Units.
8. C216-15 - Facing Brick (Solid Masonry Units Made From Clay or Shale).
9. C612-14 - Mineral Fiber Block and Board Thermal Insulation.
10. C744-14 - Prefaced Concrete and Calcium Silicate Masonry Units.
11. D1056-14 - Flexible Cellular Materials - Sponge or Expanded Rubber.
12. D2240-05(2010) - Rubber Property-Durometer Hardness.
13. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.

D. American Welding Society (AWS):

1. D1.4/D1.4M-11 - Structural Welding Code - Reinforcing Steel.

E. Brick Industry Association (BIA):

1. TN 11B-88 - Guide Specifications for Brick Masonry, Part 3.

F. Federal Specifications (Fed. Spec.):

1. FF-S-107C(2) - Screws, Tapping and Drive.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
   1. Fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies.
   2. Special masonry shapes, profiles, and placement.
   3. Masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.
C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Installation instructions.
D. Samples:
   1. Concrete masonry units, when exposed in finish work.
   2. Anchors and Ties: Each type.
   3. Joint Reinforcing: 1200 mm (48 inches) long each type.
E. Sustainable Construction Submittals:
   1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
F. Test reports: Certify products comply with specifications.
G. Certificates: Certify products comply with specifications.
   1. Solid and load-bearing concrete masonry units, including fire-resistant rated units.
H. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.

1.5 QUALITY ASSURANCE

A. Welders and Welding Procedures Qualifications: AWS D1.4/D1.4M.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products above grade, protected from contamination.
B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Hot and Cold Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.

B. Sustainable Construction Requirements:

1. Concrete Masonry Unit Recycled Content: Select products with recycled content to achieve overall Project recycled content requirement.
2. Steel Recycled Content: 30 percent total recycled content, minimum.

2.3 UNIT MASONRY PRODUCTS

A. Concrete Masonry Units (CMU):

1. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
   a. Unit Weight: Normal weight
   b. Fire rated units for fire rated partitions.
2. Sizes: Modular, 200 mm by 400 mm (8 inches by 16 inches) nominal face dimension; thickness as indicated on drawings.
3. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
4. Use bullnose concrete masonry units at corners exposed in finished work with 25 mm (1 inch) minimum radius rounded vertical exterior corners (bullnose units).

2.4 ANCHORS, TIES, AND REINFORCEMENT

A. Steel Reinforcing Bars: ASTM A615/A615M; Grade 60, deformed bars.

B. Joint Reinforcement:

1. Form from wire complying with ASTM A951/A951M.
2. Hot dipped galvanized after fabrication.
3. Width of joint reinforcement 40 mm (1.6 inches) less than nominal thickness of masonry wall or partition.
4. Cross wires welded to longitudinal wires.
5. Joint reinforcement minimum 3000 mm (10 feet) long, factory cut.
6. Joint reinforcement with crimp formed drip is not acceptable.
7. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
8. Ladder Design:

a. Longitudinal wires deformed 5 mm (0.20 inch) diameter wire.

b. Cross wires 4 mm (0.16 inch) diameter.

9. Trussed Design:

a. Longitudinal and cross wires minimum 4 mm (0.16 inch nominal) diameter.

b. Longitudinal wires deformed.

C. Adjustable Steel Beam Anchor:

1. Z or C type steel strap, 30 mm (1 1/4 inches) wide, 3 mm (1/8 inch) thick.
2. Flange hook minimum 38 mm (1 1/2 inches) long.
3. Length to embed in masonry minimum 50 mm (2 inches) in 100 mm (4 inch) nominal thick masonry and 100 mm (4 inches) in thicker masonry.
4. Bend masonry end minimum 40 mm (1 1/2 inches).

2.5 ACCESSORIES

A. Shear Keys:

1. Solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with durometer hardness of approximately 80 when tested according to ASTM D2240, and minimum shear strength of 3.5 MPa (500 psi).
2. Shear Key Dimensions: Nominal 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

B. Preformed Compressible Joint Filler:

1. Thickness and depth to fill joint.
2. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
3. Non-Combustible Type: ASTM C612, Type 5, Max. Temp.1800 degrees F.

C. Masonry Cleaner:

1. Detergent type cleaner selected for each type masonry.
2. Acid cleaners are not acceptable.
3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

D. Fasteners:

1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.

E. Welding Materials: AWS D1.4/D1.4M, type to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Keep finish work free from mortar smears or spatters and leave neat and clean.

C. Wall Openings:

1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
2. When items are not available when walls are built, prepare openings for subsequent installation.

D. Tooling Joints:

1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
2. Tool while mortar is soft enough to be compressed into joints and not raked out.
3. Finish joints in exterior face masonry work with jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
4. Tool Exposed interior joints in finish work concave unless specified otherwise.

E. Partition Height:

1. Extend partitions to overhead construction.

F. Lintels:

1. Lintels are not required for openings less than 1000 mm (40 inches) wide that have hollow metal frames.
2. Openings 1025 mm (41 inches) wide to 1600 m (63 inches) wide without structural steel lintel or frames, require lintel formed of concrete masonry lintel or bond beam units filled with grout and reinforced with one No. 16 (No. 5) rod top and bottom for each 100 mm (4 inches) of nominal thickness unless shown otherwise.
3. Precast concrete lintels of 25 MPa (3,000 psi) concrete, same thickness as partition, and with one No. 16 (No. 5) deformed bar top and bottom for each 100 mm (4 inches) of nominal thickness, is acceptable in lieu of reinforced CMU masonry lintels.
4. Use steel lintels, for openings greater than 1600 m (63 inches) wide, brick masonry openings, and elevator openings unless shown otherwise.
5. Doors having overhead concealed door closers require steel lintel, and pocket for closer box.
6. Lintel Bearing Length: Minimum 100 mm (4 inches) at both ends.
7. Build masonry openings or arches over wood or metal centering and supports when steel lintels are not used.

G. Before connecting new masonry with previously laid masonry, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.

H. Chases:

1. Do not install chases in masonry walls and partitions exposed to view in finished work, including painted or coated finishes on masonry.
2. Masonry 100 mm (4 inch) nominal thick may have electrical conduits 25 mm (1 inch) or less in diameter when covered with soaps, or other finishes.
3. Fill recess chases after installation of conduit, with mortar and finish flush.
4. When pipes or conduits, or both occur in hollow masonry unit partitions retain minimum one web of hollow masonry units.

I. Wetting and Wetting Test:
1. Test and wet brick and clay tile according to BIA TN 11B.
2. Do not wet concrete masonry units or glazed structural facing tile before laying.

J. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

K. Construct formwork to conform to shape, line and dimensions indicated on drawings. Make sufficiently tight to prevent mortar, grout, or concrete leakage. Brace, tie and support formwork as required to maintain position and shape during construction and curing of reinforced masonry.

L. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other reasonable temporary construction loads.

M. Minimum Curing Times Before Removing Shores and Forms:
1. Girders and Beams: 10 days.
2. Slabs: 7 days.
3. Reinforced Masonry Soffits: 7 days.

3.2 INSTALLATION - ANCHORAGE

A. Anchorage of Abutting Masonry:
1. Anchor interior 100 mm (4 inch) thick masonry partitions to exterior masonry walls with wall ties. Space ties at 600 mm (24 inches) maximum vertical intervals. Extend ties 100 mm (4 inches) minimum into masonry.
2. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
3. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals. Secure anchors to existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.
4. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with adjustable wall ties. Extend ties minimum 100 mm (4 inches) into joints of new masonry. Fasten ties to existing concrete and masonry construction, with powder

actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

B. Anchorage to Steel Beams or Columns:
   1. Use adjustable beam anchors on each flange.
   2. At columns weld steel rod to steel columns at 300 mm (12 inch) intervals, and place wire ties in masonry courses at 400 mm (16 inches) maximum vertically.

3.3 INSTALLATION - REINFORCEMENT

A. Joint Reinforcement:
   1. Install joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
   2. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
   3. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry.

B. Steel Reinforcing Bars:
   1. Install reinforcing bars in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for horizontal reinforcement. Install in wall cavities of reinforced masonry walls where indicated on drawings.
   2. Bond Beams:
      a. Form Bond beams of load-bearing concrete masonry units filled with grout and reinforced with two No. 15m (No. 5) reinforcing bars unless shown otherwise. Do not cut reinforcement.
      b. Brake bond beams only at expansion joints and at control joints, if shown.
   3. Stack Bond:
      a. Locate additional joint reinforcement in vertical and horizontal joints as indicated on drawings.
      b. Anchor vertical reinforcement into foundation or wall or bond beam below.
      c. Provide temporary bracing for walls over 8 feet tall until permanent horizontal bracing is completed.
   4. Grout openings:
      a. Leave cleanout holes in double wythe walls during construction by omitting units at base of one side of wall.
      b. Locate 75 mm by 75 mm (3 inches. by 3 inches.) min. cleanout holes at location of vertical reinforcement.
      c. Keep grout space clean of mortar accumulation and debris. Clean as work progresses and immediately before grouting.

3.4 INSTALLATION - BRICK EXPANSION AND CMU CONTROL JOINTS

A. Provide brick expansion joint (EJ) and CMU control joints (CJ) where indicated on drawings.

B. Keep joint free of mortar and other debris.

C. Joints Occur in Masonry Walls:

1. Install preformed compressible joint filler in brick wythe.
2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on both sides of shear key.

D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.

E. Interrupt joint reinforcement at expansion and control joints.

F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.5 INSTALLATION - BUILDING EXPANSION JOINTS

A. Keep expansion joints open and free of mortar. Remove mortar and other debris.

B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.

C. Fill opening in exposed face of expansion joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.6 INSTALLATION - ISOLATION JOINT

A. Where full height walls and partitions lie parallel or perpendicular to and under structural beams and shelf angles, provide minimum 9 mm (3/8 inch) separation between walls and partitions and bottom of beams and shelf angles.

B. Insert continuous full width strip of non-combustible type compressible joint filler.

C. Fill opening in exposed face of isolation joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.7 INSTALLATION - CONCRETE MASONRY UNITS

A. Types and Uses:

1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units. Provide solid concrete masonry units, where full units cannot be installed, or where needed for anchorage of accessories.
2. Provide solid load-bearing concrete masonry units or grout cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Provide rounded corner (bullnose) shapes at opening jambs in exposed work and at exterior corners.
4. Do not install brick jambs in exposed finish work.

5. Install concrete building brick only as filler in backup material where not exposed.
6. Construct fire resistance in fire rated partitions meeting fire ratings indicated on drawings.

B. Laying:

1. Lay concrete masonry units with 9 mm (3/8 inch) joints, with a bond overlap of minimum 1/4 of unit length, except where stack bond is indicated on drawings.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill voids with mortar or grout.
7. Provide 6 mm (1/4 inch) open joint for sealant between concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings minimum 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge masonry against steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes indicated on drawings.
12. At time of placement, ensure steel reinforcement is free of loose rust, mud, oil, and other contamination capable of affecting bond.
13. Place steel reinforcement at spacing indicated on drawings before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place vertically by centering clips, caging devices, tie wire, or other approved methods.
16. Support vertical bars near each end and at maximum 192 bar diameter on center.
17. Splice reinforcement or attach reinforcement to dowels by placing in contact and securing with wire ties.
18. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
19. Grout cells of concrete masonry units, containing reinforcing bars, solid as specified.
20. Install cavity and joint reinforcement as masonry work progresses.
21. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

C. Waterproofing Parging:

1. Parge earth side of concrete masonry unit basement walls with mortar applied in two coats, each coat 6 mm (1/4 inch) thick.
2. Clean wall surfaces to receive parging of dirt, oil, or grease, and moisten before application of first coat.
3. Roughen first coat when partially set, permit to hardened for 24 hours, and moisten before application of second coat.
4. Keep second coat damp for minimum 48 hours.
5. Thicken parging and round to form a cove at the junction of outside wall face and footing.

3.8 POINTING

A. Fill joints with pointing mortar using rubber float trowel to apply mortar solidly into raked joints.
B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.
C. Tool exposed joints to smooth concave joint.
D. At joints with existing work, match existing joint.

3.9 GROUTING

A. Preparation:
   1. Clean grout space of mortar droppings before placing grout.
   2. Close cleanouts.
   3. Install vertical solid masonry dams across grout space for full height of wall at intervals of maximum 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
   4. Verify reinforcing bars are installed as indicated on drawings.
B. Placing:
   1. Place grout in grout space in lifts as specified.
   2. Consolidate each grout lift after free water has disappeared but before plasticity is lost.
   3. Do not slush with mortar or use mortar with grout.
   4. Interruptions:
      a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inches) below top of last masonry course.
      b. Grout from dam to dam on high lift method.
      c. Longitudinal run of masonry may be stopped off only by raking back one-half masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.
C. Puddling Method:
   1. Consolidate by puddling with grout stick during and immediately after placing.
   2. Grout cores of concrete masonry units containing reinforcing bars solid as masonry work progresses.
D. Low Lift Method:

1. Construct masonry to 1.5 m (5 feet) maximum height before grouting.
2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

E. High Lift Method:
1. Do not pour grout until masonry wall has cured minimum of 4 hours.
2. Place grout in 1.5 m (5 feet) maximum lifts.
3. Exception:
   a. Where following conditions are met, place grout in 3.86 m (12.67 feet) maximum lifts.
   b. Masonry has cured minimum of 4 hours.
   c. Grout slump is maintained between 250 and 275 mm (10 and 11 inches).
   d. No intermediate reinforced bond beams are placed between top and bottom of grout lift.
4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into preceding lift.

3.10 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or approved submittal drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at spacing indicated on drawings. Support and secure vertical bars against displacement. Install horizontal reinforcement as masonry work progresses. Where vertical bars are shown in close proximity, provide clear distance between bars of minimum one bar diameter or 25 mm (1 inch), whichever is greater.

C. For columns, maintain clear distance between vertical bars as indicated on drawings, minimum 1.5 bar diameters or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated on drawings.

D. Splice reinforcement bars only where indicated on drawings, unless approved by Contracting Officer's Representative. Provide lapped splices. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

E. Provide minimum lap as indicated on approved submittal drawings, or if not indicated, minimum 48 bar diameters.

F. Weld splices where indicated on drawings according to AWS D1.4/D1.4M.

G. Embed metal ties in mortar joints as work progresses, with minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.

H. Embed prefabricated horizontal joint reinforcement as work progresses, with minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement minimum 150 mm (6 inches) at ends. Use prefabricated “L” and “T” sections to

provide continuity at corners and intersections. Cut and bend joint reinforcement for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

I. Anchoring: Anchor reinforced masonry work to supporting structure as indicated on drawings.

J. Anchor reinforced masonry walls at intersections with non-reinforced masonry.

3.11 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. Do not wet concrete masonry units (CMU).

B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to distance behind face equal to thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed 9 mm (3/8 inch) joint widths.

C. Where solid CMU units are shown, lay with full mortar head and bed joints.

D. Walls:

1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.

2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

3. Where horizontally reinforced beams (bond beams) are indicated on drawings, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

E. Columns:

1. Use CMU units of size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.

2. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.

F. Grouting:

1. Use fine grout for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.

2. Use coarse grout for filling 100 mm (4 inch) spaces or larger in both horizontal directions.

3. Grouting Technique: At Contractor’s option, use either low-lift or high-lift grouting techniques.

G. Low-Lift Grouting:

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 sq. mm (8 sq. inches) in vertical cores to be grouted.
2. Place vertical reinforcement before grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 feet) height, or if bond beam occurs below 1.5 m (5 feet) height, stop pour 38 mm (1-1/2 inches) below top of bond beam.
4. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.
5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as indicated on drawings. Place grout in bond beam course before filling vertical cores above bond beam.

H. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 75 mm (3 inches) and 6450 sq. mm (10 sq. inches), respectively.
2. Provide cleanout holes in first course at vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
4. Construct masonry to full height of maximum grout pour before placing grout.
5. Limit grout lifts to maximum height of 1.5 m (5 feet) and grout pour to maximum height of 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.
6. Place vertical reinforcement before grouting. Place before or after laying masonry units, to suit application. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 3 m (10 feet).
7. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as masonry units are laid.
10. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.
11. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as indicated on drawings, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide

minimum 4.1 mm diameter (0.16 inch) wire ties spaced 400 mm (16 inches) on center for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) on center for members with side dimensions exceeding 500 mm (20 inches).

12. Preparation of Grout Spaces: Before grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
13. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
14. Limit grout pours to sections which can be completed in one working day with maximum one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow minimum 30 minutes and maximum one hour between lifts. Mechanically consolidate each lift.
15. Place grout in lintels or beams over openings in one continuous pour.
16. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
17. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.12 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within tolerances according to ACI 530.1/ASCE 6/TMS 602 and as follows:

B. Maximum variation from plumb:
   1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
   2. In 6000 mm (20 feet) - 9 mm (3/8 inch).
   3. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).

C. Maximum variation from level:
   1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
   2. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).

D. Maximum variation from linear building lines:
   1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
   2. In 12,000 mm (40 feet) or more - 19 mm (3/4 inch).

E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
   1. Minus 6 mm (1/4 inch).
   2. Plus 13 mm (1/2 inch).

F. Maximum variation in prepared opening dimensions:
   1. Accurate to minus 0 mm (0 inch).
   2. Plus 6 mm (1/4 inch).

3.13 CLEANING AND REPAIR

A. General:
   1. Clean exposed masonry surfaces on completion.
   2. Protect adjoining construction materials and landscaping during cleaning operations.
   3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
   4. Remove mortar droppings and other foreign substances from wall surfaces.

B. Concrete Masonry Units:
   1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
   2. Allow mud to dry before brushing.

3.14 FIELD QUALITY CONTROL

A. Water Penetration Testing:
   1. Seven days before plastering or painting, in presence of Contracting Officer's Representative, test solid exterior masonry walls for water penetration.
   2. Direct water on masonry for a period of one hour when wind velocity is less than five miles per hour.
   3. Should moisture appear on inside of walls tested, make additional tests at other areas as directed by Contracting Officer's Representative.
   4. Correct areas showing moisture on inside of walls, and repeat test at repaired areas, to ensure moisture penetration has been stopped.
   5. Make water test at following locations:
      a. Eight places.

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel shapes, plates, and bars.
2. Structural pipe.
3. Bolts, nuts, and washers.

1.2 RELATED REQUIREMENTS

A. Materials Testing And Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Steel Decking: Section 05 31 00, STEEL DECKING.

C. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.

D. Steel Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.

E. Painting: Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

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

B. American Institute of Steel Construction (AISC):

1. AISC Manual - Steel Construction Manual, 14th Ed.
2. 303-10 - Code of Structural Steel Buildings and Bridges.
3. 360-10: Specification for Structural Steel Buildings.

C. The American Society of Mechanical Engineers (ASME):

1. B18.22.1-09 - Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers.

D. American Welding Society (AWS):

1. D1.1/D1.1M-15 - Structural Welding Code - Steel.

E. ASTM International (ASTM):

1. A6/A6M-14 - General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
2. A36/A36M-14 - Carbon Structural Steel.
3. A53/A53M-12 - Pipe, Steel, Black and Hot-Dip, Zinc-Coated, Welded and Seamless.
4. A123/A123M-15 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. A242/A242M-13 - High-Strength Low-Alloy Structural Steel.
6. A283/A283M-13 - Low and Intermediate Tensile Strength Carbon Steel Plates.
7. A307-14 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
8. A500/A500M-13 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.

9. A501/A501M-14 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
10. A572/A572M-15 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
11. A992/A992M-15 - Structural Shapes.
12. F2329/F2329M-15 - Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy steel Bolts, Screws, washers, Nuts, and Special Threaded Fasteners.
13. F3125/F3125M-15 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

F. Master Painters Institute (MPI):
1. No. 18 - Primer, Zinc Rich, Organic.

G. Military Specifications (Mil. Spec.):
1. MIL-P-21035 - Paint, High Zinc Dust Content, Galvanizing, Repair.

H. Occupational Safety and Health Administration (OSHA):
1. 29 CFR 1926.752(e) - Guidelines For Establishing The Components Of A Site-Specific Erection Plan.
2. 29 CFR 1926-2001 - Safety Standards for Steel Erection.

I. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
1. Specification for Structural Joints Using ASTM F3125 Bolts.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.

C. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

D. Test Reports: Certify products comply with specifications.
1. Welders' qualifying tests.

E. Certificates: Certify each product complies with specifications.
1. Structural steel.
2. Steel connections.
3. Welding materials.
4. Shop coat primer paint.

F. Qualifications: Substantiate qualifications comply with specifications.
1. Fabricator.
2. Installer.
3. Welders and welding procedures.

G. Delegated Design Drawings and Calculations: Signed and sealed by responsible Architect/Engineer.
   1. Connection calculations.
H. Record Surveys: Signed and sealed by responsible surveyor or engineer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: AISC Quality Certification participant designated as AISC Certified Plant, Category STD.
   1. Regularly fabricates specified products.
   2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.
B. Installer Qualifications: AISC Quality Certification Program participant designated as AISC-Certified Erector, Category ACSE.
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations for minimum five years.
C. Before commencement of Work, ensure steel erector provides written notification required by OSHA 29 CFR 1926.752(e). Submit a copy of the notification to Contracting Officer's Representative.
D. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where project is located.
B. Design structural steel framing connections complying with specified performance:
   1. Load Capacity: Resist loads indicated on drawings. Account for connection and member loads and eccentricities.
      a. Request additional design criteria when necessary to complete connection design.
   2. Configuration: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with details shown on drawings, supplementing where necessary. The details shown on drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the

connection and the members. Promptly notify the Contracting Officer Representative of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the Contracting Officer's Representative. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

2.2 MATERIALS

A. Per Structural General Notes.

2.3 PRODUCTS - GENERAL

A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Sustainable Construction Requirements:

1. Steel Recycled Content: 30 percent total recycled content, minimum.
2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
   a. Paints and coatings.

2.4 FABRICATION

A. Fabricate structural steel according to Chapter M, AISC 360.

B. Shop and Field Connections:

1. Weld connections according to AWS D1.1/D1.1M. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.
2. High-Strength Bolts: High-strength bolts tightened to a bolt tension minimum 70 percent of their minimum tensile strength. Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as slip-critical using Direct Tension Indicators. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

2.5 FINISHES

A. Shop Priming:

1. Prime paint structural steel according to AISC 303, Section 6.
   a. Interstitial Space Structural Steel: Prime paint, unless indicated to receive sprayed on fireproofing.

B. Shop Finish Painting: Apply primer and finish paint as specified in Section 09 91 00, PAINTING.

C. Do not paint:

1. Surfaces within 50 mm (2 inches) of field welded joints.
2. Surfaces indicated to be encased in concrete.
3. Surfaces receiving sprayed on fireproofing.

4. Beam top flanges receiving shear connector studs applied.

D. Structural Steel Galvanizing: ASTM A123/A123M, hot dipped, after fabrication. Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

1. Galvanize structural steel framing installed at exterior locations.

E. Bolts, Nuts, and Washers Galvanizing: ASTM F2329, hot-dipped.

2.6 ACCESSORIES

A. General: Shop paint steel according to AISC 303, Section 6.

B. Finish Paint System: Primer and finish as specified in Section 09 91 00, PAINTING.

C. Galvanizing Repair Paint: MPI No. 18.

PART 3 - EXECUTION

3.1 ERECTION

A. Erect structural steel according to AISC 303 and AISC 360.

B. Set structural steel accurately at locations and elevations indicated on drawings.

C. Maintain erection tolerances of structural steel within AISC 303 requirements.

1. Pour Stop Elevation Tolerance: 6 mm (1/4 inch), maximum, before concrete placement.

D. Weld and bolt connections as specified for shop connections.

3.2 FIELD PAINTING

A. After welding, clean and prime weld areas to match adjacent finish.

B. Touch-up primer damaged by construction operations.

C. Apply galvanizing repair paint to galvanized coatings damaged by construction operations.

D. Finish Painting: As specified in Section 09 91 00, PAINTING.

3.3 FIELD QUALITY CONTROL

A. Record Survey:

1. Engage registered land surveyor or registered civil engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS to perform survey.

2. Measure and record structural steel framing plumbness, level, and alignment after completing bolting and welding and before installation of work supported by structural steel.

3. Identify deviations from allowable tolerances specified in AISC Manual.

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SECTION 05 31 00
STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single pan fluted metal form deck supporting concrete fill as roof substrate.
2. Corrugated metal form deck supporting concrete fill as roof substrate.
3. Single pan fluted metal roof deck as roof substrate.
4. Acoustic metal roof deck as roof substrate.

1.2 RELATED WORK

A. Section 01 81 13. SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Section 05 21 00, STRUCTURAL STEEL FRAMING: Structural Steel Shapes.

C. Section 09 06 00, SCHEDULE FOR FINISHES: Color.

D. Section 09 91 00, PAINTING: Finish Painting.

1.3 APPLICABLE PUBLICATIONS

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

B. AISI - American Iron and Steel Institute.

S100-16.....Specification for the Design of Cold-formed Steel Structural Members.

C. American Welding Society (AWS):

D1.1/D1.1M-20.....Structural Welding Code - Steel.

1.3/D1.3M-18 .....Structural Welding Code - Sheet Steel.

D. ASTM International (ASTM):

A36/A36M-19 .....Standard Specification for Carbon Structural Steel.

A653/A653M-20 .....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

A1008/A1008M-20 .....Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Baked Hardenable.

E119-20.....Standard Test Methods for Fire Tests of Building Construction and Materials.

E. Master Painters Institute (MPI):

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

F. Military Specifications (Mil. Spec.):

MIL-P-21035B .....Paint, High Zinc Dust Content, Galvanizing Repair.

G. Steel Deck Institute (SDI):

No. 31-07 .....Design Manual for Composite Deck, Form Decks, and Roof Decks.

H. UL LLC (UL):

Listed Online Certifications Directory.

580 .....Tests for Uplift Resistance of Roof Assemblies.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.

B. Submittal Drawings:

1. Show layout, connections to supporting members, anchorage, sump pans, accessories, deck openings and reinforcements.
2. Show similar information necessary for completing installation as shown and specified, including supplementary framing, ridge and valley plates, cant strips, cut openings, special jointing or other accessories.
3. Show welding, side lap, closure, deck reinforcing and closure reinforcing details.
4. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Show steel decking section properties and structural characteristics.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Certificates: Certify each product complies with specifications.

1. Fire Resistance Product Listing: For each metal deck type and thickness supporting concrete slab or fill.

F. Qualifications: Substantiate qualifications comply with specifications.

1. Welders and welding procedures.

1.5 QUALITY ASSURANCE

A. Welders and Welding Procedures Qualifications: AWS D1.3/D1.3M.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design steel decking and accessories according to AISI S100.

1. Wind Uplift Resistance and Corner Conditions:
   a. Eave Overhang: 2.1 kPa (45 per square foot), minimum.
   b. Other Roof Areas: 1.4 kPa (30 per square foot), minimum.
2. Wind Uplift Resistance and Corner Conditions: UL 580, Class 60 or higher UL Class required by wind loading in the location of the project.
3. Fire Resistance: ASTM E119; as component of 2 hour rated roof assembly.
4. Design side and end closures and attachment to supporting steel to safely support wet weight of concrete and construction loads.
5. Cantilever Closure Deflection: 3 mm (1/8 inch), maximum.

2.2 MATERIALS

A. Galvanized Steel Sheet: ASTM A653/A653M; G60 coating.
B. Painted Steel Sheet: ASTM A1008/A1008M, Grade C or D, shop primed.
C. Primer for Shop Painted Sheets: Manufacturer's standard primer (2 coats). When finish painting of steel decking is specified in Section 09 91 00, PAINTING primer coating shall be compatible with specified finish painting.
D. Steel Shapes: ASTM A36/A36M.

2.3 PRODUCTS - GENERAL

A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
B. Sustainable Construction Requirements:
   1. Steel Recycled Content: 30 percent total recycled content, minimum.

2.4 METAL ROOF DECK

A. Metal Roof Deck: UL Listed as metal roof deck panels.
   1. Steel decking of the type, depth, thickness, and section properties as shown.
B. Metal Roof Deck: Single pan fluted units with flat horizontal top surfaces as permanent support for superimposed loads.
   1. Deck Style: As indicated on drawings.
   2. Depth and Thickness: As indicated on drawings.
   3. Material: Galvanized sheet steel.
C. Do not use steel deck for hanging supports of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.

2.5 FABRICATION

A. Fabricate steel decking in sufficient lengths to extend over 3 or more supports, except for interstitial levels.
   1. Cut metal deck units to proper length in shop.
B. Fabricate accessories required to complete installation of steel decking.
   1. Exposed to View: Fabricate from sheet steel matching metal decking.
   2. Concealed from View: Fabricate from galvanized sheet steel.

C. Sheet Metal Accessories:

1. Metal Cover Plates: For end-abutting decking, to close gaps at changes in deck direction, columns, walls and openings.
   a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges.
   a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
3. Metal Closure Strips: For openings between decking and other construction. Form to configurations required to provide tight-fitting closures at open ends of flutes and sides of decking.
   a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
4. Ridge and Valley Plates: Minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 1/24 (1/2 inch per foot).
   a. Sheet Steel: Minimum 1.0 mm (0.04 inch) thick.
5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the drawings. Fabricate cant strips with minimum 125 mm (5 inch) face width.
   a. Sheet Steel: Minimum 0.8 mm (0.03 inch) thick.
6. Seat Angles for Deck: Provide where beam does not frame into column.
7. Sump Pans for Roof Drains: Fabricated from single piece galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain. Provide sump pans of adequate size to receive roof drains and with bearing flanges minimum 75 mm (3 inches) wide. Recess pans minimum 38 mm (1-1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Drain holes will be field cut.
   a. Sheet Steel: Minimum 1.7 mm (0.06 inch) thick.

2.6 FINISHES

A. Shop prime painted sheet steel with two coats of primer.

2.7 ACCESSORIES

A. Primer: Manufacturer's standard primer compatible with finish painting specified in Section 09 91 00, PAINTING.
B. Welding Materials: AWS D1.1, type to suit application.
C. Galvanizing Repair Paint: MPI No. 18.
D. Touch-Up Paint: Match shop finish.

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 contaminates from structural steel surfaces where steel decking will be welded.

D. Verify structural steel framing installation is completed, plumbed, and aligned with temporary bracing installed where required.

E. Coordinate with structural steel erector to prevent overloading of structural members when placing steel decking for installation.

3.2 ERECTION

A. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace deck units that become damaged after erection and before casting concrete at no cost additional to the Government.

B. Place steel decking at right angles to supporting members with ends located over supports as indicated on Structural Drawings.

C. Lap end joints 50 mm (2 inches), minimum. See Structural General Notes.

D. Fluted Form Deck Fastening:

1. Fasten form deck to steel supporting members as indicated on Structural Drawings.
2. End Closure Fastening as indicated on Structural Drawings.
3. Fasten side laps of adjacent decking units as indicated on Structural Drawings.

E. Roof Deck Fastening:

1. Fasten decking to steel supporting members as indicated on Structural Drawings.
2. Fasten split or partial decking panels to structure in every valley.
3. Fasten decking to each supporting member at ribs where side laps occur.
4. Mechanically fasten decking side laps as indicated on Structural Drawings.
5. Provide additional fastening necessary to comply with UL Listing for specified performance.

F. Cutting and Fitting:

1. Field cut steel decking to accommodate columns and other penetrating items.
2. Cut openings located and dimensioned on Structural Drawings.
3. Coordinate openings for other penetrations shown on approved submittal drawings but not shown on Structural Drawings.
   a. Cut and reinforce required opening.
4. Make cuts neat and trim using metal saw, drill or punch-out device. Cutting with torches is prohibited.
5. Do not make cuts in the metal deck that are not shown on the approved metal decking submittal drawings.
   a. When additional openings are required, submit scaled drawing, locating required opening and other openings and supports in immediate area.
   b. Do not cut the opening until drawing is approved by Contracting Officer's Representative.
   c. Provide additional reinforcing and framing required for opening.
   d. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected steel decking.

6. Opening Reinforcement: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work.

G. Touch up damaged factory finishes.

1. Apply galvanizing repair paint to damaged galvanized surfaces.
2. Apply touch up paint to damaged shop painted surfaces.

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.

B. Items specified.

1. Support for Wall and Ceiling Mounted Items
2. Railings

1.2 RELATED WORK

A. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Prime and finish painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data:

Grating, each type	Floor plate
Trap door	Wheel guards
Ceiling hatch	Sidewalk Access door
Manhole Covers	Safety nosing

C. Shop Drawings:

1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
3. Provide templates and rough-in measurements as required.

D. Manufacturer's Certificates:

1. Anodized finish as specified.
2. Live load designs as specified.

E. Design Calculations for specified live loads including dead loads.

F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.

B. Each product type shall be the same and be made by the same manufacturer.

C. Assembled product to the greatest extent possible before delivery to the site.

D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):

B18.6.1-97.....Wood Screws

B18.2.2-87(R2010).....Square and Hex Nuts

C. American Society for Testing and Materials (ASTM):

A36/A36M-14 .....Structural Steel

A47-99(R2014).....Malleable Iron Castings

A48-03(R2012).....Gray Iron Castings

A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A123-15.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

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

A269-15.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A307-14.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

A391/A391M-07(R2015) .....Grade 80 Alloy Steel Chain

A786/A786M-15 .....Rolled Steel Floor Plate

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B456-11.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

B632-08.....Aluminum-Alloy Rolled Tread Plate

C1107-13 .....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

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

F436-16 ..... Hardened Steel Washers

F468-06(R2015) ..... Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws and Studs for General Use

F593-13 ..... Stainless Steel Bolts, Hex Cap Screws, and Studs

F1667-15 ..... Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):

D1.1-15..... Structural Welding Code Steel

D1.2-14..... Structural Welding Code Aluminum

D1.3-18..... Structural Welding Code Sheet Steel

E. National Association of Architectural Metal Manufacturers (NAAMM)

AMP 521-01(R2012) ..... Pipe Railing Manual

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

MBG 531-09(R2017)..... Metal Bar Grating Manual

MBG 532-09 ..... Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:

SP 1-15 ..... No. 1, Solvent Cleaning

SP 2-04 ..... No. 2, Hand Tool Cleaning

SP 3-04 ..... No. 3, Power Tool Cleaning

G. Federal Specifications (Fed. Spec):

RR-T-650E ..... Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.

C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

2.2 MATERIALS

A. Structural Steel: ASTM A36.

B. Stainless Steel: ASTM A240, Type 302 or 304.

C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.

D. Floor Plate:

1. Steel ASTM A786.
2. Aluminum: ASTM B632.

F. Cast-Iron: ASTM A48, Class 30, commercial pattern.

G. Malleable Iron Castings: A47.

H. Primer Paint: As specified in Section 09 91 00, PAINTING.

I. Stainless Steel Tubing: ASTM A269, type 302 or 304.

J. Modular Channel Units:
   1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
   2. Form channel within turned pyramid shaped clamping ridges on each side.
   3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
   4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
   5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

K. Grout: ASTM C1107, pourable type.

L. Insect Screening: ASTM D3656.

2.3 HARDWARE

A. Rough Hardware:
   1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
   2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:
   1. Bolts with Nuts:
      a. ASME B18.2.2.
      b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
      c. ASTM F468 for nonferrous bolts.
      d. ASTM F593 for stainless steel.
   2. Screws: ASME B18.6.1.
   3. Washers: ASTM F436, type to suit material and anchorage.
   4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION GENERAL

A. Material
   1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
   2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:

1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

C. Connections
1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors
1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship
1. General:
   a. Fabricate items to design shown.
   b. Furnish members in longest lengths commercially available within the limits shown and specified.
   c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.

d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
f. Prepare members for the installation and fitting of hardware.
g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.

2. Welding:
   a. Weld in accordance with AWS.
   b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
   c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
   d. Finish welded joints to match finish of adjacent surface.
3. Joining:
   a. Miter or butt members at corners.
   b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
   a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
   b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
   a. Accurately cut, machine and fit joints, corners, copes, and miters.
   b. Fit removable members to be easily removed.
   c. Design and construct field connections in the most practical place for appearance and ease of installation.
   d. Fit pieces together as required.
   e. Fabricate connections for ease of assembly and disassembly without use of special tools.
   f. Joints firm when assembled.
   g. Conceal joining, fitting and welding on exposed work as far as practical.

h. Do not show rivets and screws prominently on the exposed face.

j. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:

1. Finish exposed surfaces in accordance with NAAMM AMP 500 Metal Finishes Manual.
2. Aluminum: NAAMM AMP 501.
   a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
   b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
   c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
   d. Painted: AA-C22R10.
3. Steel and Iron: NAAMM AMP 504.
   a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
   b. Surfaces exposed in the finished work:
      1) Finish smooth rough surfaces and remove projections.
      2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
   c. Shop Prime Painting:
      1) Surfaces of Ferrous metal:
         a) Items not specified to have other coatings.
         b) Galvanized surfaces specified to have prime paint.
         c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
         d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
         e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
      2) Non ferrous metals: Comply with MAAMM-500 series.

G. Protection:

1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 SUPPORTS

A. General:
   1. Fabricate ASTM A36 structural steel shapes as shown.
   2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
   3. Field connections may be welded or bolted.

C. For Wall Mounted Items:
   1. For items supported by metal stud partitions.
   2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
   3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
   4. Steel hat channels where shown. Flange cut and flatted for anchorage to stud.

2.6 LOOSE LINTELS

A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.

B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.

C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.
   1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
   2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

E. Provide bearing plates for lintels where shown.

F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.

G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.

H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.

I. Elevator Entrance:
   1. Fabricate lintel from plate bent to channel shape, and provide a minimum of 100 mm (4 inch) bearing each end.
   2. Cut away the front leg of the channel at each end to allow for concealment behind elevator hoistway entrance frame.

2.7 RAILINGS

A. In addition to the dead load design railing assembly to support live load specified.

B. Fabrication General:
   1. Provide continuous welded joints, dressed smooth and flush.

2. Standard flush fittings, designed to be welded, may be used.
3. Exposed threads will not be approved.
4. Form rail brackets to size and design shown.
5. Exterior Post Anchors.
   a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
   b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
   c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts. Base plates are not required on pipe sleeves where ornamental railings occur.
6. Interior Post Anchors:
   a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
   b. Weld or thread flanged fitting to posts at base.
   c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
   d. Provide sliding flange base plate on posts secured with set screws.
   e. Weld flange base plate to removable posts set in sleeves.

C. Exterior Handrails:
1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.

D. Steel Pipe Railings:
1. Fabricate of steel pipe with welded joints.
2. Number and space of rails as shown.
3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
4. Form handrail brackets from malleable iron.
5. Fabricate removable sections with posts at end of section.
6. Removable Rails:
   a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
   b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
   c. Continuously weld brackets to post.
   d. Provide slotted bolt holes in rail bracket.
   e. Weld bolt heads flush with top of rail.
   f. Weld flanged fitting to post where posts are installed in sleeves.
7. Opening Guard Rails:

a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.

b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.

c. Fabricate rails for floor openings for anchorage in sleeves.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Items set into concrete or masonry.

1. Provide temporary bracing for such items until concrete or masonry is set.
2. Place in accordance with setting drawings and instructions.
3. Build strap anchors, into masonry as work progresses.

C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.

D. Field weld in accordance with AWS.

1. Design and finish as specified for shop welding.
2. Use continuous weld unless specified otherwise.

E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

H. Secure escutcheon plate with set screw.

3.2 INSTALLATION OF SUPPORTS

A. Anchorage to structure.

1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
2. Secure supports to concrete inserts by bolting or continuous welding as shown.
3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
4. Secure steel plate or hat channels to studs as detailed.

3.3 STEEL LINTELS

A. Use lintel sizes and combinations shown or specified.

B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.

C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

3.4 RAILINGS

A. Steel Posts:
   1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
   2. Install sleeves in concrete formwork.
   3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS-on exterior posts.
   4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
   5. Secure sliding flanged fittings to posts at base with set screws.
   6. Secure fixed flanged fittings to concrete with expansion bolts.
   7. Secure posts to steel with welds.

B. Anchor to Walls:
   1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
      a. Anchor steel plate to concrete or solid masonry with expansion bolts.
      b. Anchor steel plate to hollow masonry with toggle bolts.
   2. Anchor flanged fitting with toggle bolt to steel support in frame walls.

C. Exterior Handrails:
   1. Anchor brackets for metal handrails as detailed.
   2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
   3. Expansion bolt to concrete or solid masonry.
   4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

3.5 STEEL COMPONENTS FOR MILLWORK ITEMS

Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

3.6 CLEAN AND ADJUSTING

A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.

B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

- - - E N D - - -

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies wood blocking, framing, sheathing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

1.2 RELATED WORK:

A. Sustainable design requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Milled woodwork: Section 06 20 00, FINISH CARPENTRY.

C. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

1.3 SUBMITTALS:

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

B. Sustainable Design Submittals, as described below:

1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.
2. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
3. For composite wood products, submit documentation indicating that product contains no added urea formaldehyde.

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

D. Manufacturer’s Literature and Data:

1. Submit data for lumber, panels, hardware and adhesives.
2. Submit data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
3. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.

E. Manufacturer’s certificate for unmarked lumber.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect lumber and other products from dampness both during and after delivery at site.

B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

C. Stack plywood and other board products so as to prevent warping.

D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 QUALITY ASSURANCE:

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

1.6 GRADING AND MARKINGS:

A. Any unmarked lumber or plywood panel for its grade and species will not be allowed on VA Construction sites for lumber and material not normally grade marked, provide manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material meet the specified the specified requirements.

1.7 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Forest and Paper Association (AFPA):
NDS-15.....National Design Specification for Wood Construction
WCD1-01 .....Details for Conventional Wood Frame Construction

C. American Institute of Timber Construction (AITC):
A190.1-07.....Structural Glued Laminated Timber

D. American Society of Mechanical Engineers (ASME):
B18.2.1-12(R2013).....Square and Hex Bolts and Screws
B18.2.2-10.....Square and Hex Nuts
B18.6.1-81(R2008).....Wood Screws

E. American Plywood Association (APA):
E30-11.....Engineered Wood Construction Guide

F. ASTM International (ASTM):
A653/A653M-13 .....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process
C954-11 .....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness
C1002-14 .....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs
D198-14 .....Test Methods of Static Tests of Lumber in Structural Sizes
D2344/D2344M-13.....Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates

D2559-12a .....Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions

D3498-03(R2011) .....Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems

D6108-13 .....Test Method for Compressive Properties of Plastic Lumber and Shapes

D6109-13 .....Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products

D6111-13a .....Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement

D6112-13 .....Test Methods for Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes

F844-07a(R2013).....Washers, Steel, Plan (Flat) Unhardened for General Use

F1667-13.....Nails, Spikes, and Staples

G. American Wood Protection Association (AWPA):

AWPA Book of Standards

H. Commercial Item Description (CID):

A-A-55615 .....Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)

I. Forest Stewardship Council (FSC):

FSC-STD-01-001(Ver. 4-0)FSC Principles and Criteria for Forest Stewardship

J. Military Specification (Mil. Spec.):

MIL-L-19140E .....Lumber and Plywood, Fire-Retardant Treated

K. Environmental Protection Agency (EPA):

40 CFR 59(2014) .....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

M. U.S. Department of Commerce Product Standard (PS)

PS 1-95 .....Construction and Industrial Plywood

PS 20-10 .....American Softwood Lumber Standard

N. ICC Evaluation Service (ICC ES):

AC09 .....Quality Control of Wood Shakes and Shingles

AC174 .....Deck Board Span Ratings and Guardrail Systems (Guards and Handrails)

PART 2 - PRODUCTS

2.1 LUMBER:

A. Unless otherwise specified, each piece of lumber must bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.

1. Identifying marks are to be in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Structural Members: Species and grade as listed in the AFPA NDS having design stresses as shown.

C. Lumber Other Than Structural:
1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
2. Framing lumber: Minimum extreme fiber stress in bending of 7584 kPa (1100 PSI).
3. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.
4. Board Sub-flooring: Shiplap edge, 25 mm (1 inch) thick, not less than 203 mm (8 inches) wide.

D. Sizes:
1. Conforming to PS 20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:
1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
   a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
   b. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:
1. Comply with Mil Spec. MIL-L-19140.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:
1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 610 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).

4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

2.3 PLYWOOD:

A. Comply with PS 1.

B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.

C. Sheathing:

1. APA rated Exposure 1 or Exterior; panel grade CD or better.

D. Subflooring:

1. As indicated on Structural Drawings.

E. Underlayment:

1. APA rated Exposure 1 or Exterior, panel grade C-C Plugged.
2. Minimum 6 mm (1/4 inch) thick or greater over plywood subflooring and 9 mm (3/8 inch) thick or greater over board subflooring, unless otherwise shown.

2.4 STRUCTURAL-USE PANELS:

A. Comply with APA E30.

B. Bearing the mark of a recognized association or independent agency that maintains continuing control over quality of panel which identifies compliance by end use, Span Rating, and exposure durability classification.

C. Subflooring:

1. Under finish wood flooring or underlayment:
   a. APA rated sheathing panels, durability classification of Exposure 1 or Exterior.
   b. Span Rating of 24/16 or greater for supports 406 mm (16 inches).
2. Under resilient floor or carpet.
   a. APA rated combination subfloor-underlayment grade panels, durability classification of Exposure 1 or Exterior T and G.
   b. Span Rating of 16 or greater for supports 406 mm (16 inches) on center and 24 or greater for supports 610 mm (24 inches) on center.

D. Underlayment:

1. APA rated Exposure I.
2. Minimum 6 mm (1/4 inch) thick or greater over subfloor.

E. Laminated Veneer Lumber (LVL):

1. Bonded jointed wood veneers with ASTM D2559 adhesive.
2. Scarf jointed wood veneers with grain of wood parallel.
3. Size as indicated on contract documents.

2.5 ROUGH HARDWARE AND ADHESIVES:

A. Anchor Bolts:
   1. ASME B18.2.1 and ASME B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
   2. Extend at least 203 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).

B. Miscellaneous Bolts: Expansion Bolts: C1D A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Provide 13 mm (1/2 inch) bolt unless shown otherwise.

C. Washers
   1. ASTM F844.
   2. Provide zinc or cadmium coated steel or cast iron for washers exposed to weather.

D. Screws:
   1. Wood to Wood: ASME B18.6.1 or ASTM C1002.
   2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:
   1. Size and type best suited for purpose unless noted otherwise. Provide aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
   2. ASTM F1667:
      a. Common: Type I, Style 10.
      b. Concrete: Type I, Style 11.
      c. Barbed: Type I, Style 26.
      d. Underlayment: Type I, Style 25.
      e. Masonry: Type I, Style 27.
      f. Provide special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

F. Framing and Timber Connectors:
   1. Fabricate of ASTM A653/A653M, Grade A; steel sheet not less than 1.3 mm (0.052 inch) thick unless specified otherwise. Apply standard plating to steel timber connectors after punching, forming and assembly of parts.
   2. Framing Angles: Angle designed with bendable legs to provide three (3) way anchors.
   3. Straps:
      a. Designed to provide wind and seismic ties with sizes as shown or specified.
      b. Strap ties not less than 32 mm (1-1/4 inches) wide.
      c. Punched for fastener.
   4. Metal Bridging:

a. V shape deformed strap with not less than two (2) nail holes at ends, designed to nail to top and side of framing member and bottom and side of opposite member.
b. Not less than 19 by 127 mm (3/4 by 5 inches) bendable nailing flange on ends.
c. Fabricated of 1 mm (0.04 inch) minimum thick sheet.

5. Joist Hangers:
   a. Fabricated of 1.6 mm (0.063 inch) minimum thick sheet, U design unless shown otherwise.
   b. Heavy duty hangers fabricated of minimum 2.7 mm (0.108 inch) thick sheet, U design with bent top flange to lap over beam.
6. Timber Connectors: Fabricated of steel to shapes indicated on contract drawings.
7. Joist Ties: Mild steel flats, 5 mm by 32 mm (3/16 inch by 1-1/4 inch) size with ends bent about 30 degrees from horizontal, and extending at least 406 mm (16 inches) onto framing. Punch each end for three (3) spikes.
8. Joint Plates:
   a. Steel plate punched for nails.
   b. Steel plates formed with teeth or prongs for mechanically clamping plates to wood.
   c. Size for axial eccentricity, and fastener loads.

G. Adhesives:
1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.
2. For structural laminated Wood: ASTM D2559.
3. Adhesives to have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:
1. AFPA NDS for timber connectors.
2. AITC A190.1 Timber Construction Manual for heavy timber construction.
3. AFPA WCD1 for nailing and framing unless specified otherwise.
4. APA for installation of plywood or structural use panels.

B. Fasteners:
1. Nails.
   a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA WCD1 where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
   b. Use special nails with framing connectors.

c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.

d. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.

e. Use 16d or larger nails for nailing through 50 mm (2 inch) thick lumber.

f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.

g. Nailing Schedule; Using Common Nails:

1) Joist bearing on sill or girder, toe nail three (3) 8d nails or framing anchor.

2) Bridging to joist, toe nail each end two (2) 8d nails.

3) Ledger strip to beam or girder three (3) 16d nails under each joint.

4) Subflooring or Sheathing:

a) 152 mm (6 inch) wide or less to each joist face nail two (2) 8d nails.

b) Subflooring, more than 152 mm (6 inches) wide, to each stud or joint, face nail three (3) 8d nails.

c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 152 mm (6 inches) on center and at intermediate supports 254 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 305 mm (12 inches) at supported edges and 508 mm (20 inches) o.c. at intermediate supports.

5) Sole plate to joist or blocking, through sub floor face nail 20d nails, 406 mm (16 inches) on center.

6) Top plate to stud, end nail two (2) 16d nails.

7) Stud to sole plate, toe nail or framing anchor. Four (4) 8d nails.

8) Doubled studs, face nail 16d at 610 mm (24 inches) on center.

9) Built-up corner studs 16d at 610 mm (24 inches) (24 inches) on center.

10) Doubled top plates, face nails 16d at 406 mm (16 inches) on center.

11) Top plates, laps, and intersections, face nail two (2) 16d.

12) Continuous header, two pieces 16d at 406 mm (16 inches) on center along each edge.

13) Ceiling joists to plate, toenail three (3) 8d or framing anchor.

14) Continuous header to stud, four (4) 16d.

15) Ceiling joists, laps over partitions, face nail three (3) 16d or framing anchor.

16) Ceiling joists, to parallel rafters, face nail three (3) 16d.

17) Rafter to plate, toe nail three (3) 8d or framing anchor. Brace 25 mm (1 inch) thick board to each stud and plate, face nail three (3) 8d.

18) Built-up girders and beams 20d at 812 mm (32 inches) on center along each edge.

2. Bolts:
   a. Fit bolt heads and nuts bearing on wood with washers.
   b. Countersink bolt heads flush with the surface of nailers.
   c. Embed in concrete and solid masonry or provide expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
   d. Provide toggle bolts to hollow masonry or sheet metal.
   e. Provide bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 610 mm (24 inch) intervals between end bolts. Provide clips to beam flanges.
3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
   a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
   b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
   a. Where shown or option to nails.
   b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
   c. Spaced same as nails.
7. Installation of Timber Connectors:
   a. Conform to applicable requirements of the AFPA NDS.
   b. Fit wood to connectors and drill holes for fasteners so wood is not split.

C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
   1. Space anchor bolts 1219 mm (4 feet) on centers between ends and within 152 mm (6 inches) of end. Stagger bolts from side to side on plates over 178 mm (7 inches) in width.
   2. Provide shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
   3. Closely fit, and set to required lines.

D. Cut notch, or bore in accordance with AFPA WCD1 passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.

E. Blocking Nailers, and Furring:
   1. Install furring, blocking, nailers, and grounds where shown.
   2. Provide longest lengths practicable.
   3. Provide fire retardant treated wood blocking where shown at openings and where shown or specified.

4. Layers of Blocking or Plates:
   a. Stagger end joints between upper and lower pieces.
   b. Nail at ends and not over 610 mm (24 inches) between ends.
   c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.

F. Floor and Ceiling Framing:
1. Set with crown edge up.
2. Keep framing at least 50 mm (2 inches) away from chimneys.
3. Bear on not less than 101 mm (4 inches) on concrete and masonry, and 38 mm (1-1/2 inches) on wood and metal unless shown otherwise.
4. Support joist, trimmer joists, headers, and beams framing into carrying members at same relative levels on joist hangers unless shown otherwise.
5. Lap and spike wood joists together at bearing, or butt end-to-end with scab ties at joint and spike to plates. Scab tie lengths not less than 203 mm (8 inches) lap on joist ends. Install wood I beam joists as indicated in contract documents.
6. Frame openings with headers and trimmer joist. Double headers carrying more than two tail joists and trimmer joists supporting headers carrying more than one tail joist unless otherwise indicated in contract documents.
7. Drive nails through headers into joists using two (2) nails for 50 mm by 152 mm (2 inch by 6 inch); three (3) nails for 50 mm by 203 mm (2 inch by 8 inch) and four (4) nails for 50 mm by 254 mm (2 inch by 10 inch) and over in size.
8. Install nearest joist to double headers and spike joist to both header members before trimmer joist is installed and secured together.
9. Doubled joists under partitions parallel with floor joists. Fire cut joists built into masonry or concrete.
10. Where joists run perpendicular to masonry or concrete, anchor every third joist to masonry or concrete with one (1) metal wall anchor. Securely spike anchors with three (3) nails to side of joist near its bottom.
11. Anchor joists running parallel with masonry or concrete walls to walls with steel flats spaced not over 1828 mm (6 feet) apart. Extend steel flats over at least three (3) joists and into masonry 101 mm (4 inches) with ends turned 50 mm (2 inches); bolt to concrete. Set top of flats flush with top of joists, and securely nail steel flats to each joist.
12. Hook ties at steel framing over top flange of steel members.
13. Where ceramic tile finish floors are set in Portland cement mortar, nail continuous 50 mm by 75 mm (2 inches by 3 inches) ledgers to sides of joists to support subflooring flush with top of joist.

G. Bridging:

1. Provide 25 mm by 75 mm (1 inch by 3 inch) lumber with ends beveled for slope. Option: Metal bridging may be provided in lieu of wood bridging.
2. Install one (1) row of bridging for joist spans over 2438 mm (8 feet), but less than 4877 mm (16 feet) long; install two (2) rows for spans over 4877 mm (16 feet) long.
3. Install an extra row of bridging between trimmer and next two (2) joists if header is more than 610 mm (2 feet) from end of trimmer or from regular row of bridging.
4. Secure with two (2) nails at ends.
5. Leave bottom ends loose until after subflooring or roof sheathing is installed.
6. Install single row of bridging at centerline of span and two (2) rows at the third points of span unless otherwise shown.

H. Rough Bucks:
1. Install rough wood bucks at opening in masonry or concrete where wood frames or trim occur.
2. Brace and maintain bucks plumb and true until masonry has been built around them or concrete cast in place.
3. Cut rough bucks from 50 mm (2 inch) thick stock, of same width as partitions in which they occur and of width shown in exterior walls.
4. Extend bucks full height of openings and across head of openings; fasten securely with anchors specified.

I. Subflooring:
1. Subflooring as indicated on Structural Drawings.
2. Lay board subflooring diagonally, with close joints. Stagger end joints and make joints over supports. Bear each board on at least three supports.
3. Provide a clearance of approximately 13 mm (1/2 inch) at masonry or concrete at walls.
4. Apply plywood and structural-use panel subflooring with face grain or long dimension at right angles to the supports, with edges 6 mm (1/4 inch) apart at side joints, and 3 mm (1/8 inch) apart at end joints.
5. Combination subfloor-underlayment:
   a. Space edges 3 mm (1/8 inch) apart.
   b. Provide a clearance of 6 mm (1/4 inch) at masonry on concrete at walls.
6. Stagger panel end joints and make over support.

J. Underlayment:
1. Where finish flooring of different thickness is used in adjoining areas, provide underlayment of thickness required to bring finish-flooring surfaces into same plane.
2. Apply to dry, level, securely nailed, clean, wood subfloor without any projections.
3. Plywood and particle underlayment are to be glue-nailed to subfloor.

4. Butt underlayment panels to a light contact with a 1 mm (1/32 inch) space between plywood or hardboard underlayment panels and walls, and approximately 9 mm (3/8 inch) between particleboard underlayment panels and walls.
5. Stagger underlayment panel end joints with respect to each other and offset joints with respect to joints in the subfloor at least 50 mm (2 inches).
6. After installation, avoid traffic on underlayment and damage to the finish surface.

K. Sheathing:

1. Provide plywood for sheathing.
2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
3. Set nails not less than 9 mm (3/8 inch) from edges.
4. Install 50 mm by 101 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.
5. Match and align sheathing which is an extension of work in place to existing.

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SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior millwork

B. Items specified:
   1. Wall Paneling.
   2. Chair Rail.
   3. Moldings
   4. Base.

1.2 RELATED REQUIREMENTS

A. Adhesive, Paint, and Finish VOC Limits: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Woodwork Finish and Color: Refer to construction documents.

C. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.

D. Wood doors: Section 08 14 00, WOOD DOORS.

E. Other Countertops: Division 11, EQUIPMENT and Division 12, FURNISHINGS.

F. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International:

A36/A36M-19 ..... Carbon Structural Steel.

A53/A53M-20 ..... Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

A240/A240M-20 ..... Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

B26/B26M-18e1 ..... Aluminum-Alloy Sand Castings.

B221-14..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E84-20..... Surface Burning Characteristics of Building Materials.

C. American Hardboard Association (AHA):

A135.4-12..... Basic Hardboard.

D. Architectural Woodwork Institute (AWI):

AWI-14 ..... Architectural Woodwork Standards, 2nd ed.

E. Builders Hardware Manufacturers Association (BHMA):

A156.16-18..... Auxiliary Hardware.

F. Federal Specifications (Fed. Spec.):

A-A-1922A.....Shield Expansion (Calking Anchors, Single Lead).

A-A-1936A.....Adhesive, Contact, Neoprene Rubber.

FF-N-836E .....Nut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding.

FF-S-111D(1).....Screw, Wood (Notice 1 inactive for new design).

MM-L-736C(1).....Lumber, Hardwood.

G. Hardwood Plywood and Veneer Association (HPVA):

HP1-16 .....Hardwood and Decorative Plywood.

H. Military Specification (Mil. Spec):

MIL-L-19140E .....Lumber and Plywood, Fire-Retardant Treated.

I. National Particleboard Association (NPA):

A208.1-09.....Wood Particleboard.

J. U.S. Department of Commerce, Product Standard (PS):

PS1-07 .....Construction and Industrial Plywood.

PS20-10 .....American Softwood Lumber Standard.

1.4 PREINSTALLATION MEETINGS

A. Conduct pre-installation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. Architect/Engineer and Interior Designer.
   c. Contractor.
   d. 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. 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. Millwork items - Half full-size scale for sections and details 1: 50 (1/4 inch) for elevations and plans.

C. Manufacturer's Literature and Data:
1. Description of each product.
a. Finish hardware.
b. Sinks with fittings.
c. Electrical components.
2. List of acceptable sealers for fire retardant materials.
3. Installation instructions.

D. Samples:
1. Approved samples may be incorporated into work.

E. Certificates: products comply with specifications.
1. Fire retardant treatment of materials.
2. Moisture content of materials.

F. Qualifications: Substantiate qualifications comply with specifications.
1. Fabricator with project experience list.
2. Installer with project experience list.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications:
1. Regularly fabricates specified products.
2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.
a. Project Experience List: Provide contact names and addresses for completed projects.

B. Installer Qualifications:
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.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

D. Store products indoors in dry, weathertight conditioned facility.

E. Protect products from damage during handling and construction operations.

1.8 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.
4. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

B. Field Measurements: Verify field conditions affecting fabrication and installation. Show field measurements on Submittal Drawings.
   1. Coordinate field measurement and fabrication schedule to avoid delay.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grading and Marking: Factory mark with grade stamp lumber and plywood of inspection agency approved by the Board of Review, American Lumber Standard Committee.

B. Lumber:
   1. Sizes:
      a. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes within manufacturing tolerances allowed by the standard under which product is produced.
      b. Millwork, standing and running trim, and rails: Actual size as shown or specified.
   2. Hardwood: Match existing conditions.
   3. Softwood: Match existing conditions.
   4. Moisture Content:
      a. 32 mm (1-1/4 inches) or less nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
      b. Other materials: According to standards under which the products are produced.
   5. Fire Retardant Treatment: Mil. Spec. MIL-L-19140E.
      a. Treatment and performance inspection by an independent and qualified testing agency that establishes performance ratings.
      b. Each piece of treated material bear identification of the testing agency and indicate performance according to such rating of flame spread and smoke developed.
      c. Treat wood for maximum flame spread of 25 and smoke developed of 25.
      d. Fire Resistant Softwood Plywood:

1) Grade A, Exterior, plywood for treatment.
2) Surface Burning Characteristics: When tested according to ASTM E84.
a) Flame spread: 0 to 25.
b) Smoke developed: 100 maximum.

e. Fire Resistant Hardwood Plywood:
1) Core: Fire retardant treated softwood plywood.
2) Hardwood face and back veneers untreated.
3) Factory seal panel edges.

C. Plywood:
1. Softwood Plywood: DOC PS1.
a. Plywood, 13 mm (1/2 inch) and thicker; minimum five ply construction, except 32 mm (1-1/4 inch) thick plywood minimum seven ply.
b. Plastic Laminate Plywood Cores:
1) Exterior Type, and species group.
2) Veneer Grade: A-C.
c. Shelving Plywood:
1) Interior Type, any species group.
2) Veneer Grade: A-B or B-C.
d. Other: As specified for item.
2. Hardwood Plywood: HPVA: HP.1.
a. Species of Face Veneer: Match existing conditions. As shown or as specified with each particular item.
b. Grade:
1) Transparent Finish: Type II (interior) A grade veneer.
2) Paint Finish: Type II (interior) Sound Grade veneer.
c. Species and Cut: Match existing

D. Building Board (Hardboard):
1. ANSI/AHA A135.4, 6 mm (1/4 inch) thick unless specified otherwise.
2. Perforated hardboard (Pegboard): Type 1, Tempered perforated 6 mm (1/4 inch) diameter holes, on 25 mm (1 inch) centers each way, smooth surface one side.

E. Stainless Steel: ASTM A240, Type 302 or 304.

F. Cast Aluminum: ASTM B26.

G. Extruded Aluminum: ASTM B221.

2.2 PRODUCTS - GENERAL

A. Basis of Design: Refer to construction documents.

B. Provide each product from one manufacturer.

2.3 FABRICATION

A. General:
   1. AWI Custom Grade for interior millwork.
   2. Finish woodwork, free from pitch pockets.
   3. Trim, standard stock molding and members of same species, except where special profiles are shown.
   4. Plywood, minimum 13 mm (1/2 inch), unless otherwise shown on Drawings or specified.
   5. Edges of members in contact with concrete or masonry having a square corner caulking rebate.
   6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded.
   7. Fabricate interior trim and items of millwork to be painted from jointed, built-up, or laminated members, unless otherwise shown on Drawings or specified.
   8. Solid Hardwood:
      a. White oak or red oak, number one common grade.
      b. Tongue and groove, including end matched.
      c. Thickness: Minimum 19 mm (3/4 inch).
      d. Random Lengths minimum 600 mm (24 inches), 57 mm (2-1/4 inches) wide.
   9. Trim and Base:
      a. Quarter round at ceiling and vertical edge.
      b. Two-member base as shown on Drawings.
   10. Furring Strips: Nominal 25 mm by 100 mm (1 inch by 4 inch) softwood.

2.4 ACCESSORIES

A. Hardware:
   1. Rough Hardware:
      a. Provide rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electric-galvanizing process. Galvanized where specified.
      b. Fasteners:
         1) Bolts with Nuts: FF-N-836.
         2) Expansion Bolts: A-A-1922A.
         3) Screws: Fed. Spec. FF-S-111.

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 moldings to permit new installation.

1. Retain existing moldings for reuse.
2. Dispose of other removed materials.

D. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION

A. Installation:
1. Prime millwork receiving transparent finish and back-paint concealed surfaces.
2. Fasten trim with fine finishing nails, screws, or glue as required.
3. Set nails for putty stopping. Provide washers under bolt heads where no other bearing plate occurs.
4. Seal cut edges of fire retardant treated wood materials with a certified acceptable sealer.
5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
6. Plumb and level items unless shown otherwise.
7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.
8. Apply adhesive uniformly for full contact between wood and substrate.

B. Wall Paneling:
1. Solid Hardwood Boards:
a. Install furring strips, 25 by 75 mm (1 by 3 inch) at 400 mm (16 inch) centers horizontally between top and bottom strips. Fasten each stud with two screws.
b. Install paneling laid vertically with end joints staggered between adjacent boards.
c. Tightly butt joints and blind nail each board at each furring strip.
2. Edge Trim and Base: Install solid wood as shown on Drawings, species same as wall paneling.

3.3 CLEANING

A. Remove excess adhesive before adhesive sets.
B. Clean exposed surfaces. Remove contaminants and stains.
C. Touch up damaged factory finishes.
1. Repair painted surfaces with touch up primer.

3.4 PROTECTION

A. Protect finish carpentry from traffic and construction operations.
B. Cover finish carpentry with reinforced kraft paper, and plywood or hardboard.
C. Remove protective materials immediately before acceptance.
D. Repair damage.

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SECTION 07 21 13
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermal insulation.
   a. Board or block insulation at foundation perimeter.
   b. Batt or blanket insulation at exterior framed walls.
   c. Board or block insulation at floor assemblies above unconditioned spaces.
2. Acoustical insulation.
   a. Semi-rigid insulation at interior framed partitions.
   b. Batt and blanket insulation at interior framed partitions and ceilings.
   c. Board insulation at interior concrete and masonry partitions.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Adhesives VOC Limits.

B. Section 04 20 00, UNIT MASONRY: Insulation for Cavity Face of Masonry.

C. Section 07 21 23, LOOSE-FILL INSULATION: Loose Fill Insulation for Attic Floors.

D. Section 07 40 00, ROOFING AND SIDING PANELS: Insulation for Insulated Wall Panels.

E. Section 07 84 00, FIRESTOPPING: Safing Insulation.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

C516-19 .....Vermiculite Loose Fill Thermal Insulation.

C549-18 .....Perlite Loose Fill Insulation.

C552-17e1 .....Cellular Glass Thermal Insulation.

C553-13(2019).....Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

C578-19 .....Rigid, Cellular Polystyrene Thermal Insulation.

C591-20 .....Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

C612-14(2019).....Mineral Fiber Block and Board Thermal Insulation.

C665-17 .....Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

C728-17a .....Perlite Thermal Insulation Board.

C954-18 .....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Base to Steel Studs From 0.033 (0.84 mm) inch to 0.112 inch (2.84 mm) in thickness.

C1002-18 .....Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

D312/D312M-16a.....Asphalt Used in Roofing.

E84-20.....Surface Burning Characteristics of Building Materials.

F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show insulation type, thickness, and R-value for each location.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Adhesive indicating manufacturer recommendation for each application.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
2. Low Pollutant-Emitting Materials: Show volatile organic compound types and quantities.

1.5 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

C. Protect foam plastic insulation from UV exposure.

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 INSULATION - GENERAL

A. Insulation Thickness:

1. Provide thickness required by R-value shown on drawings.

B. Insulation Types:

1. Provide one insulation type for each application.

C. Sustainable Construction Requirements:

1. Insulation Recycled Content:

a. Glass fiber reinforced: 6 percent recovered material.

2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
    a. Non-Flooring Adhesives and Sealants.

2.2 THERMAL INSULATION

A. Continuous Insulation:
    1. Polyisocyanurate ASTM C1289 Type 1, Class 1.

B. Exterior Framing or Furring Insulation:
    1. Mineral Fiber: ASTM C665, Type II, Class C, Category I where concealed by thermal barrier.
    2. Mineral Fiber: ASTM C665, Type III, Class A at other locations.

C. Inside Face of Exterior Wall Insulation:
    1. Mineral Fiber Board: ASTM C612, Type IB or II.
    2. Perlite Board: ASTM C728.
    3. Cellular Glass Block: ASTM C552, Type I.

D. Floor Assemblies Above Unconditioned Spaces:
    1. Mineral Fiber Board: ASTM C612, Type IB or Type II.
    2. Perlite Board: ASTM C728.
    3. Cellular Glass Block: ASTM C552, Type I.

2.3 ACOUSTICAL INSULATION

A. Semi Rigid, Batts and Blankets:
    1. Widths and lengths to fit tight against framing.
    2. Mineral Fiber Batt or Blankets: ASTM C665 unfaced.
    3. Maximum Surface Burning Characteristics: ASTM E84.
        a. Flame Spread Rating: 25.
        b. Smoke Developed Rating: 450.

2.4 ACCESSORIES

A. Fasteners:
    1. Staples or Nails: ASTM F1667, zinc-coated, size and type to suit application.
    2. Screws: ASTM C954 or ASTM C1002, size and length to suit application with washer minimum 50 mm (2 inches) diameter.
    3. Impaling Pins: Steel pins with head minimum 50 mm (2 inches) diameter.
        a. Length: As required to extend beyond insulation and retain cap washer when washer is placed on pin.
        b. Adhesive: Type recommended by manufacturer to suit application.

B. Insulation Adhesive: Nonflammable type recommended by insulation manufacturer to suit application.

C. Tape: Pressure sensitive adhesive on one face.

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. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Install batt and blanket insulation with joints tight. Fill framing voids completely. Seal penetrations, terminations, facing joints, facing cuts, tears, and unlapped joints with tape.

C. Fit insulation tight against adjoining construction and penetrations, unless indicated otherwise.

3.3 THERMAL INSULATION

A. Perimeter Insulation In Contact with Soil:

1. Vertical insulation:

a. Fill joints of insulation with same material used for bonding.

b. Bond polystyrene board to surfaces with adhesive.

c. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.

2. Horizontal insulation under concrete floor slab:

a. Lay insulation boards and blocks horizontally on level, compacted and drained fill.

b. Extend insulation from foundation walls towards center of building minimum 600 mm (24 inches).

B. Exterior Framing or Furring Insulation:

1. General:

a. Open voids are not acceptable.

b. Pack insulation around door frames and windows, in building expansion joints, door soffits, and other voids.

c. Pack behind outlets, around pipes, ducts, and services encased in walls.

d. Hold insulation in place with pressure sensitive tape.

e. Lap facing flanges together over framing for continuous surface. Seal penetrations through insulation and facings.

2. Metal Studs: Fasten insulation between metal studs, framing, and furring with pressure sensitive tape continuous along flanged edges.

3. Wood Studs:

a. Fasten insulation between wood studs or framing with nails or staples through flanged edges on face of stud.

b. Space fastenings maximum 150 mm (six inches) apart.

4. Roof Rafters and Floor Joists: Friction fit insulation between framing to provide minimum 50 mm (2 inch) air space between insulation and roof sheathing and subfloor.

C. Inside Face of Exterior Wall Insulation:

1. Location: On interior face of solid masonry and concrete walls, beams, beam soffits, underside of floors, and to face of studs to support interior wall finish where indicated.
2. Bond insulation to solid vertical surfaces with adhesive. Fill joints with adhesive cement.
3. Fasten board insulation to face of studs with screws, nails or staples. Space fastenings maximum 300 mm (12 inches) on center. Stagger fasteners at board joints. Install fasteners at each corner.

D. Floor Assemblies Above Unconditioned Spaces:

1. Use impaling pins for attach insulation to underside of horizontal surfaces. Space fastenings as required to hold insulation in place and prevent sagging.
   a. Bond insulation with adhesive when separate vapor retarder is used.

3.4 ACOUSTICAL INSULATION

A. General:

1. Install insulation without voids.
2. Pack insulation around door frames and windows, in building expansion joints, door soffits, and other voids.
3. Pack behind outlets, around pipes, ducts, and services encased in walls.
4. Hold insulation in place with pressure sensitive tape.
5. Lap facer flanges together over framing for continuous surface. Seal all penetrations through the insulation and facers.
6. Do not compress insulation below required thickness except where embedded items prevent required thickness.

B. Semi Rigid, Batts and Blankets:

1. When insulation is not full thickness of cavity, adhere insulation to one side of cavity, maintaining continuity of insulation and covering penetrations or embedments.
   a. Wood Framing:
      1) Fasten blanket insulation between wood framing and joists with nails or staples through flanged edges of insulation.
      2) Space fastenings maximum 150 mm (6 inches) on center.
   b. Metal Framing:
      1) Fasten insulation between metal framing with pressure sensitive tape continuous along flanged edges.
      2) At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing.

3) Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.

3.5 CLEANING

A. Remove excess adhesive before adhesive sets.

3.6 PROTECTION

A. Protect insulation from construction operations.

B. Repair damage.

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SECTION 07 21 23
LOOSE-FILL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Loose-fill insulation at the attic.

1.2 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

C612-14(2019) ..... Mineral Fiber Block and Board Thermal Insulation.

C728-17a ..... Perlite Thermal Insulation Board.

C739-17 ..... Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation.

C764-19 ..... Mineral Fiber Loose Fill Thermal Insulation.

C1015-17 ..... Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation.

D4397-16 ..... Polyethylene Sheeting for Construction, Industrial, and Agriculture Applications.

C. National Fire Protection Associations (NFPA):

211-19 ..... Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances.

D. Occupational Safety and Health Administration (OSHA):

Code of Federal Regulations 29 CFR 1910, Occupational Safety and Health Act (OSHA).

1.3 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. Include copy of packaging label.
3. Installation instructions.

C. Samples:

1. Loose-fill insulation: 0.5 liter (1 pint).
2. Blocking: 150 mm (6 inch) long.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

1.4 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
   1. Include referenced specification number, type and class as applicable, recommended method of installation (pneumatic or pouring), minimum net weight of insulation, coverage charts, R-values, and required warning statements.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.5 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.
B. Protect products from damage during handling and construction operations.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Provide insulation from one manufacturer.
B. Sustainable Construction Requirements:
   1. Insulation Recycled Content:
   2. Loose-Fill Insulation: 75 percent total recycled content, minimum.

2.2 LOOSE-FILL INSULATION

A. Mineral Fiber Loose-fill: ASTM C764, Type I or II.

2.3 ACCESSORIES

A. Blocking: Wood, metal, mineral fiber or perlite boards, or other materials approved by Contracting Officer’s Representative.
   1. Mineral Fiber Board: ASTM C612, Type IB.
   2. Perlite Board: ASTM C728.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine locations receiving loose-fill insulation according to ASTM C1015. Identify the following:
   1. Defects in electrical fixtures, equipment, wiring, junction boxes, receptacles, and switches.
   2. Openings through which loose-fill insulation material may escape.
   3. Air ducts with unsealed joints.
B. Report unsatisfactory conditions to Contracting Officer's Representative.
C. Do not install insulation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Examine and verify substrate suitability for product installation.
B. Protect existing construction and completed work from damage.
C. Install blocking in accordance ASTM C1015 and as indicated.
   1. Opening Blocking:

a. Install blocking around attic trap doors and vents if the level to which the unsettled insulation will be installed exceeds their height.
b. Cover openings into attic with temporary blocking to prevent insulation from falling into opening, including spaces enclosed by blockings.

2. Device Blocking: Install blocking 50 mm (2 inches) above height of finished insulation installation to ensure devices requiring maintenance or servicing remain accessible after insulation is installed.
3. Heat Producing Device Blocking: Minimum clearances for blocking around heat producing devices.
   a. Masonry Chimneys: 100 mm (4 inches) from outside face of masonry servicing fired equipment operating at maximum 800 degrees C (1500 degrees F).
   b. Other Chimneys, Vents, Breechings, and Stacks: Minimum clearances as required by NFPA 211.

3.3 INSTALLATION

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
B. Insulation:
   1. Install insulation according to ASTM C1015.
   2. Fit the attic side of trap doors and access panels with perlite or mineral fiber insulation boards. Insulate attic side of trap doors unless prevented by retractable ladder.
   3. Install insulation in sufficient depth to provide thermal value specified after insulation settlement.
   4. Pneumatic installation:
      a. Use lowest air pressure according to manufacturer's instructions.
      b. Do not blow insulation into electrical devices and vents opening into insulated spaces.
   5. Install insulation and allow natural settlement to final density. Do not tamp or rod insulation.

3.4 FIELD QUALITY CONTROL

A. Post Installation Procedures: According to ASTM C1015.

3.5 CLEANING

A. Remove excess insulation.
B. Remove temporary blockings over openings.

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SECTION 07 22 00
ROOF AND DECK INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

B. Roof and deck insulation, on new metal deck substrates ready to receive roofing or waterproofing membrane.

C. Repairs and alteration work to existing roof insulation.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Non-Flooring Adhesives and Sealants VOC Limits.

B. Section 06 10 00, ROUGH CARPENTRY: Wood Cants, Blocking, and Edge Strips.

1.3 APPLICABLE PUBLICATIONS

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

B. American Society of Civil Engineers

ASCE 7-16 ..... Minimum Design Loads and Associated Criteria for Buildings and Other Structures

C. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):

Standard 90.1-13 ..... Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASTM International (ASTM):

C208-12(2017)e2 ..... Cellulosic Fiber Insulating Board.

C552-17e1 ..... Cellular Glass Thermal Insulation.

C726-17 ..... Mineral Fiber Roof Insulation Board.

C728-17a ..... Perlite Thermal Insulation Board.

C1177/C1177M-17 ..... Glass Mat Gypsum Substrate for Use as Sheathing.

C1278/C1278M-17 ..... Fiber-Reinforced Gypsum Panel.

C1289-19 ..... Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

C1396/C1396M-17 ..... Gypsum Board.

D41/D41M-11 (2016) ..... Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

D312/D312M-16a ..... Asphalt Used in Roofing.

D1970/D1970M-20 ..... Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

D2178/D2178M-15a ..... Asphalt Glass Felt Used in Roofing and Waterproofing.

D2822/D2822M-05(2011)e1 ..... Asphalt Roof Cement, Asbestos Containing.

D4586/D4586M-07(2018) ..... Asphalt Roof Cement, Asbestos-Free.

E84-20.....Surface Burning Characteristics of Building Materials.

F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.

E. National Roofing Contractors Association (NRCA):

Manual-15 .....The NRCA Roofing Manual: Membrane Roof Systems-2019.

F. UL LLC (UL):

Listed Online Certifications Directory.

G. U.S. Department of Agriculture (USDA):

USDA BioPreferred Program Catalog.

H. U.S. Department of Commerce National Institute of Standards and Technology (NIST):

DOC PS 1-19 .....Structural Plywood.

DOC PS 2-18 .....Performance Standard for Wood-Based Structural-Use Panels.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and installation details.
   a. Nailers, cants, and terminations.
   b. Layout of insulation showing slopes, tapers, penetrations, and edge conditions.

C. Manufacturer's Literature and Data:

1. Description of each product.

D. Samples:

1. Roof insulation, each type.
2. Fasteners, each type.

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.
3. Low Pollutant-Emitting Materials:
   a. Show volatile organic compound types and quantities.

F. Qualifications: Substantiate qualifications meet specifications.

1. Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Same installer as Division 07 roofing section installer.

1.6 DELIVERY

A. Comply with recommendations of NRCA Manual.

B. Deliver products in manufacturer's original sealed packaging.

C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.

D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Comply with recommendations of NRCA Manual.

B. Store products indoors in dry, weathertight facility.

C. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment: Install products when existing and forecasted weather permit installation according to manufacturer's instructions.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant substrate board, vapor retarder, insulation, and cover board against material and manufacturing defects as part of Division 07 roofing system warranty.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Insulation Thermal Performance:

1. Overall Average R-Value: RSI-57 (R-33), minimum.
2. Any Location R-Value: RSI-17 (R-10), minimum.

B. Fire and Wind Uplift Resistance: Provide roof insulation complying with requirements specified in Division 07 roofing section.

C. Insulation on Metal Decking: UL labeled indicating compliance with one of the following:

1. UL Listed.
2. Insulation Surface Burning Characteristics: When tested according to ASTM E84.
   a. Flame Spread Rating: 75 maximum.
   b. Smoke Developed Rating: 150 maximum.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

B. Sustainable Construction Requirements:

1. Insulation Recycled Content:
   a. Mineral Fiber: 75 percent total recycled content, minimum.
   b. Fiberglass: 20 percent total recycled content, minimum.
   c. Cellulose: 75 percent post-consumer recycled content, minimum.
   d. Perlite Composite Board: 23 percent post-consumer recycled content, minimum.
   e. Rigid Foam: 9 percent total recycled content, minimum.
   f. Glass Fiber Reinforced Rigid Foam: 6 percent total recycled content, minimum.
2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
   a. Non-flooring adhesives and sealants.

3. Bio-Based Materials: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to www.biopreferred.gov.

2.3 ADHESIVES

A. Primer: ASTM D41/D41M.

B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.

C. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to adhere roof insulation to substrate or to another insulation layer.

D. Bead-Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to adhere roof insulation to substrate or to another insulation layer.

E. Full-Spread Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to adhere roof insulation to substrate or to another insulation layer.

F. Roof Cement: Asbestos free, ASTM D2822/D2822M, Type I or Type II; or, ASTM D4586/D4586M, Type I or Type II.

2.4 ROOF AND DECK INSULATION

A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam.

C. Tapered Roof Insulation System:

1. Fabricate of mineral fiberboard, polyisocyanurate, perlite board, or cellular glass. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
2. Cut to provide high and low points with crickets and slopes as shown.
3. Minimum thickness of tapered sections; 38 mm (1-1/2 inch).
4. Minimum slope 1/48 (1/4 inch per 12 inches).

2.5 INSULATION ACCESSORIES

1. Glass-Mat, Water-Resistant Gypsum Roof Board: ASTM C1177/C1177M, 16 mm (5/8 inch) thick, factory primed.

2.6 ACCESSORIES

A. Fasteners: Corrosion-resistant carbon steel fasteners and galvalume-coated steel or plastic round plates for fastening substrate board and insulation to roof deck.

B. Nails: ASTM F1667; type to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Comply with requirements of Division 07 roofing section.

3.2 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

3.3 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Comply with requirements of UL for insulated steel roof deck.

C. Attach substrate board and other products to meet requirements of Division 07 roofing section.

3.4 SUBSTRATE BOARD INSTALLATION

A. Fasten substrate board to top flanges of steel decking to resist uplift pressures according to requirements for specified roofing system.

1. Locate the long dimension edge joints solidly bearing on top of decking ribs.

3.5 INSULATION INSTALLATION

A. Insulation Thickness:

1. Thickness of roof insulation shown on drawings is nominal. Provide thickness required to comply with specified thermal performance.
2. Insulation on Metal Decks: Provide insulation in minimum thickness recommended by insulation manufacturer to span deck flutes. Support edges of insulation on metal deck ribs.
3. When actual insulation thickness differs from drawings, coordinate alignment and location of roof drains, flashing, gravel stops, fascias and similar items.
4. Where tapered insulation is used, maintain insulation thickness at high points and roof edges shown on drawings.
   a. Low Point Thickness: Minimum 38 mm (1-1/2 inches).
5. Use minimum two layers of insulation when required thickness is 68 mm (2.7 inch) or greater.

B. Lay insulating units with close joints, in regular courses and with end joints staggered.

1. Stagger joints between layers minimum 150 mm (6 inches).

C. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.

D. Seal cut edges at penetrations and at edges against blocking with bitumen or roof cement.

E. Cut to fit tightly against blocking or penetrations.

F. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.

G. Installation Method:

1. Mechanically Fastened Insulation:

a. Fasten insulation according to requirements in Division 07 roofing section.
b. Fasten insulation to resist uplift pressures specified in Division 07 roofing section and ASCE-7.

2. Mechanically Fastened and Adhered Insulation:
   a. Fasten first layer of insulation according to "Mechanically Fastened Insulation" requirements.
   b. Fasten each subsequent layer of insulation according to "Adhered Insulation" requirements.

3.6 COVER BOARD INSTALLATION

A. Install cover boards over insulation with long joints in continuous straight lines with staggered end joints.
B. Offset cover board joints from insulation joints 150 mm (6 inches), minimum.
C. Secure coverboards according to "Mechanically Fastened Insulation" requirements.

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SECTION 07 31 13
ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fiberglass asphalt shingles over underlayment nailed to roof sheathing.

1.2 RELATED WORK

A. Section 07 60 00, FLASHING AND SHEET METAL: Counterflashing and Flashing of Roof Projections.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

D226/D226M-17 ..... Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

D1970/D1970M-19 ..... Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

D3018/D3018M-11(2017) ..... Class A Asphalt Shingles Surfaced with Mineral Granules.

D3161/D3161M-20 ..... Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method).

D3462/D3462M-19 ..... Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.

F1667-18a ..... Driven Fasteners: Nails, Spikes, and Staples.

C. UL LLC (UL):

790(Edition 8) ..... Fire Tests of Roof Coverings.

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. Installation instructions.
3. Warranty.

C. Samples: Shingles: Full size each type, color and texture.

D. Sustainable Construction Submittals:

1. Solar Reflectance Index (SRI) for asphalt shingles.

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, manufacture date, and the label of Underwriters Laboratories.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

A. Store shingles according to manufacturer's instructions. Store roll goods on end in upright position.

B. Protect products from damage during handling and construction operations.

C. Keep materials dry, covered completely and protected from weather.

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant asphalt shingles against material and manufacturing defects.

1. Material Warranty Period: 25 years.
2. Wind-Speed Warranty Period: Resist wind speeds up to 180 km/h (110 mph) for 15 years.
3. Algae-Resistance Warranty Period: No discoloration for 20 years.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Provide each product from one manufacturer.

1. Provide each product exposed to view from one production run.

C. Sustainable Construction Requirements:

1. Solar Reflectance Index: 25, minimum.

2.2 ASPHALT SHINGLES

A. Asphalt Shingles: Fiberglass reinforced, laminated type, square butt.

1. ASTM D3462/D3462M and ASTM D3018/D3018M, Type I, self-sealing.
2. ASTM D3161/D3161M, Class F wind-resistant.
3. UL 790 Class A fire resistance.
4. Minimum Weight: 10.3 kg/square meter (210 lbs./100 square feet).

2.3 ROOFING NAILS

A. ASTM F1667, Type I, Style 20, galvanized steel, deformed shanks, heads 10 mm to 11 mm (3/8 inch to 7/16 inch) diameter.

1. Nails for Shingles: 32 mm (1-1/4 inches) long.
2. Nails for Felt: 19 mm (3/4 inch) long.

2.4 ROOFING UNDERLAYMENT

A. Organic Felt: ASTM D226/D226M, Type I.

B. Self-Adhering Modified Bituminous Underlayment: ASTMD1970/D1970M.

2.5 METAL FLASHING

A. Provide metal roof flashings, including apron flashings, step flashings, valley flashings, drip edges, and vent pipe flashings specified in Section 07 60 00, FLASHING AND SHEET METAL.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for roofing installation.
   1. Verify roof substrates are sound, within manufacturer's tolerances, and free from defects which would interfere with roofing installation.
   2. Verify roof accessories, vent pipes and other projections through roof are in place and roof flashing is installed, or ready for installation, before installing shingles.

B. Protect existing construction and completed work from damage.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 METAL DRIP EDGE INSTALLATION

A. At eaves and rakes, install stainless steel drip edges specified in Section 07 60 00, FLASHING AND SHEET METAL.
   1. Eaves: Install metal drip edge before underlayment.
   2. Rakes: Install metal drip edge after underlayment.

B. Secure metal drip edges with compatible nails spaced maximum 250 mm (10 inches) on center along inner edges.

3.4 FLASHING INSTALLATION

A. Install metal flashings specified in Section 07 60 00, FLASHING AND SHEET METAL at intersections of roofs, adjoining walls, or projections through deck such as chimneys, vent stacks, and cupolas

B. Install metal valley flashing shown and as specified under Section 07 60 00, FLASHING AND SHEET METAL.
   1. Secure valley flashing according to shingle manufacturer's instructions.
   2. Expose flashing in open portion of valley 125 mm (5 inches) minimum, and lap shingles over flashing 125 mm (5 inches) minimum.

3.5 UNDERLAYMENT INSTALLATION

A. Install self-adhering sheet underlayment, working from low point to high point. Lap sides 90 mm (3-1/2 inches) minimum, and lap ends 150 mm (6 inches) minimum. Install at the following locations:
   1. Eaves and Rakes: From edge of eave and rake to 600 mm (24 inches) minimum beyond inside face of exterior wall.
      a. Lap underlayment over eave metal drip edge.
   2. Valleys, Hips and Roof Slope Transitions: Centered over change in slope and extended 450 mm (18 inches) minimum on both sides.

3. Ridges: Centered on ridge and extended 900 mm (36 inches) minimum on both sides.
4. Sidewalls and Projections through Roof: Extended 450 mm (18 inches) from projection and extended up projection 100 mm (4 inches) minimum.
5. Firmly roll underlayment to ensure adhesion to roof deck and metal flashings.

B. Install organic felt underlayment on roof deck not covered by self-adhering sheet underlayment, with 100 mm (4 inches) minimum end laps, 50 mm (2 inches) minimum head laps, and 300 mm (12 inches) minimum ridge laps. Nail felt 125 mm (5 inches) on centers along laps.

3.6 ROOF ACCESSORY INSTALLATION

A. Install skylights specified in Section 08 63 00, METAL-FRAMED SKYLIGHTS before installing shingles.

B. Lap underlayment and asphalt shingles over upslope base flanges of roof accessory flashings.

C. Install underlayment and asphalt shingles over side slope base flanges of roof accessory flashings.

D. Install downslope base flanges of roof accessories over asphalt shingles.

3.7 ASPHALT SHINGLE INSTALLATION

A. Install shingles aligned parallel to roof eave, nailed to roof sheathing.

1. Exposure: 190.5 mm (7 ½ inches) maximum.
2. Head lap: 50 mm (2 inches) minimum.

B. Install asphalt-shingle starter strip with tabs removed, and overhanging lower edge of roof 13 mm (1/2 inch).

C. Valleys: Closed.

3.8 HIP AND RIDGE SHINGLE INSTALLATION

A. Bend each shingle lengthwise down center to provide equal exposure on both sides of hip and ridge.

1. Begin ridge installation at leeward end of ridge.
2. Begin hip installation at eave.

B. Install shingles with maximum 125 mm (5 inches) exposure.

C. Secure each shingle with one nail on both sides of hip and ridge, 215 mm (8-1/2 inches) back from exposed end and one inch up from edge.

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SECTION 07 40 00
SIDING PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies uninsulated metal wall panels as shown on contract documents.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 07 92 00, JOINT SEALANTS: Sealant.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide metal wall panels and products of a manufacturer regularly engaged for not less than five (5) years in the fabrication of metal panels of the type and design indicated.

B. Installer: A firm with three (3) years of successful experience with installation of siding panels of type and scope equivalent to Work of this Section. Submit installer qualifications.

1.4 SUBMITTALS

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

B. Sustainable Design Submittals, as described below:

1. Postconsumer recycled content as specified in PART 2 - PRODUCTS.

C. Samples: Metal panel, 152 mm (6 inch) square, showing finish, each color and texture.

D. Shop Drawings: Wall panels, showing details of construction and installation. Collateral steel framing thickness and kind of material, closures, flashing, fastenings and related components and accessories. Show interfaces and relationships to work at other trades and continuity with adjacent thermal, weather, air and vapor barriers.

E. Manufacturer's Literature and Data: Wall panels

F. Fire Test Report: Report of fire test by recognized testing laboratory for fire rating specified, showing details of construction.

G. Manufacturer’s Certificates: Indicating manufacturer’s qualifications specified.

H. Installer qualifications.

I. Manufacturer warranty.

1.5 QUALITY ASSURANCE

A. Approval by Contracting Officer Representative (COR) is required of products of proposed manufacturer.

B. Certify manufacturer has five (5) years continuous documented experience in fabrication of metal roofing and siding panels.

C. Source: For each material type required for work of this section, provide primary materials, which are products of one manufacturer. Provide secondary or accessory materials, which are acceptable to manufacturers of primary materials.

D. Installer: A firm with a minimum of three (3) years' experience in type of work required by this section and which is acceptable to manufacturers of primary materials.

1.6 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their metal wall panels for a minimum of ten (10) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

C. Warranty on Panel Finishes: Manufacturer's shall warrant their wall panel finish and provide standard agreement to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when testing according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of installation and final acceptance by the COR.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.

B. American Architecture Manufacturers Association (AAMA):

611-14 ..... Anodized Architectural Aluminum

621-02 ..... Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

2605-13 ..... Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

C. American Iron and Steel Institute (AISI):

SG03-02 ..... Cold-Formed Steel Design Manual

D. ASTM International (ASTM):

A463/A463M-15..... Steel Sheet, Cold-Rolled, Aluminum-Coated, by the Hot-Dip Process

A653/A653M-20..... Steel Sheet, Zinc-Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

A924/A924M-19..... Steel Sheet, Metallic Coated by the Hot-Dip Process

A1008/A1008M-18..... Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy
B209-14 ..... Aluminum and Aluminum Alloy Sheet and Plate
B209M-14 ..... Aluminum and Aluminum Alloy Sheet and Plate (Metric)
C553-19..... Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
C591-20. ..... Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
C612-14(2019) ..... Mineral Fiber Block and Board Thermal Insulation
C1396/C1396M-17 ..... Gypsum Board
D2244-16..... Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
D4214-07(2015) ..... Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
E119-20 ..... Fire Test of Building Construction and Materials
E283-19 ..... Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
E331-00(2016)..... Test Method for Water Penetration of Exterior Windows, Skylight, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
E1592-05(2017)..... Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Method
E1646-95(2018)..... Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
E1680-16 ..... Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems
E1980-11(2019)..... Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
E2140-01(2017)..... Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS FOR WALL PANELS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592.
   1. Wind Loads: As indicated.

2. Other Design Loads: Permanent deformation not to exceed L/175 in accordance with ASTM E 330.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
4. Minimum Panel depth: 1-1/4”.
5. Panel width: Varies. As indicated on drawings
6. Panel length: No more than 10’

B. Condensation: System shall accommodate positive drainage for moisture entering or condensation occurring within panel system.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joints sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 67 degrees C (120 degrees F), ambient; 100 degrees C (180 degrees F), material surfaces.

2.2 ALUMINUM PLATE AND SHEET

A. ASTM B209M (B209).

2.3 FASTENERS

A. Fasteners for Aluminum Panels to be stainless steel.

B. Fasteners of size, type and holding strength as recommended by panel manufacturer.

2.4 THERMAL INSULATING MATERIALS

A. Urethane or Isocyanurate Board: ASTM C591, Type I.

2.5 FABRICATION

A. General:

1. Furnish panels in one continuous length as indicated on drawings. Panels shall be factory fabricated and no field cuts are permitted.
2. Construct panels by pressing members together to form a structural unit with closed ends.
3. Overall thickness of panels is shown of the contract documents.
4. Provide connection between panels by interlocking male and female joints.
5. Provide collateral steel framing, metal and bituminous closures, fastenings, flashing, clip, caulking, panel reinforcements for support of mechanical and electrical work as shown on the contract documents, and related components and accessories.
   a. Sub-girts: 1.0 mm (0.0396 inches) thick galvanized steel hat channels deigned to receive panel fasteners or clips.
   b. Accessories, fastenings, and flashings to be the same material and finish as the panels. Thickness and installation of accessories and flashing to be as recommended by the panel manufacturer.

B. Uninsulated Metal Panels:

1. Panels to consist of a structurally reinforced air-space fastened between two metal face sheets.
2. Panels:
   a. 0.050 inch thick aluminum.

2.6 FINISH

A. For uninsulated wall panels, provide finishes as indicated on drawings for face sheets. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Provide aluminum alloy for color coating as required to produce specified color. Provide color as specified in Drawings. Color for sheet aluminum to not deviate more than the colors of extrusion samples.
   1. Weather Face: Polyvinylidene Flouride (PVDF) coil coating with 70 percent Kynar 500 or Hylar 5000 resin content.
   2. Primer: UV-resistant, 0.210 mil thick epoxy modified acrylic.
   3. Color coat: 0.80 mil PVDF

C. Performance:
   1. Change of Color: Maximum 5 DE (Hunter Units), tested to ASTM D2244
   2. Chalking: No. 8 rating tested to ASTM D4214, Photographic Reference Standard No. 1 Test Method D659.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install panels in accordance with the manufacturer's approved erection instructions and diagrams, except as specified otherwise.

B. Install panels in full and firm contact with supports and with each other at side and end laps.

C. Where panels are cut in the field, or where factory applied coverings or coatings are abraded or damaged in handling or installation, make finish repairs with material of the same type and color as the weather coating, before being installed.

D. Seal cut ends and edges, including those at openings through the sheets.

E. Correct defects or errors in the materials in a manner approved by the COR.

F. Replace defective materials which cannot be corrected with nondefective material.

G. Provide molded closure strips where indicated and whenever sheets terminate with open ends after installation.

H. Wall Panels:
   1. Apply panels with the configuration in a horizontal and vertical position.
   2. Provide panels in the longest obtainable lengths, with end laps occurring as shown on drawings.

3. Flash and seal walls at the base, at the top, around windows, door frames, framed louvers, and other similar openings. Install closure strips, flashings, and sealing material in an approved manner that will assure complete weather tightness.

I. Flashing:
1. Provide flashing and related closures and accessories in connection with the preformed metal panels as indicated and as necessary to provide a watertight installation.
2. Install details of installation, which are not indicated, in accordance with the panel manufacturer's printed instruction and details, or the approved shop drawings.
3. Allow for expansion and contraction of flashing.

J. Fasteners:
1. Space fasteners in accordance with the manufacturer's recommendations, and as necessary to withstand the design loads indicated.
2. Install fasteners in valleys or crowns as recommended by the manufacturer of the panel being used.
3. Install fasteners in straight lines within a tolerance of 13 mm (1/2-inch) in the length of a bay.
4. Drive exposed penetrating type fasteners normal to the surface, and to a uniform depth to seat gasketed washers properly, and drive so as not to damage factory applied coating.
5. Exercise care in drilling pilot holes for fastenings to keep drills perpendicular and centered in valleys, or crowns, as applicable. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Do not torque fasteners to exceed values recommended by the manufacturer.
6. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels.
7. Remove metal shavings and filings from roofs on completion to prevent rusting and discoloration of the panels.

3.2 ISOLATION OF ALUMINUM

A. Isolate aluminum in contact with or fastened to dissimilar metals other than stainless steel, white bronze, or other metal compatible with aluminum by one of the following:
1. Painting the dissimilar metal with a prime coat of Zinc-Molybdate followed by two coats of aluminum paint.
2. Placing a non-abrasive tape or gasket between the aluminum and the dissimilar metal.

B. Paint aluminum in contact with, or built into mortar, concrete, plaster, or other masonry materials with a coat of alkali-resistant bituminous paint.

C. Paint aluminum in contact with wood or other absorptive materials that may become repeatedly wet, with two coats of bituminous paint, or two coats of aluminum paint. Seal joints with caulking material.

3.3 PROTECTION AND CLEANING

A. Protect panels and other components from damage during and after erection, and until project is accepted by the COR.

B. After completion of work, all exposed finished surfaces of panels are to be cleaned of soil, discoloration and disfiguration. Touch-up abraded surfaces of panels.

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SECTION 07 54 23

THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoplastic Polyolefin (TPO) sheet roofing adhered to roof deck.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Non-Flooring Adhesives and Sealants VOC Limits.

B. Section 07 22 00, ROOF AND DECK INSULATION: Roof Insulation.

1.3 APPLICABLE PUBLICATIONS

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

B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):

FX-1-16 ..... Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.

C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):

7-16 ..... Minimum Design Loads for Buildings and Other Structures.

D. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):

90.1-13 ..... Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. ASTM International (ASTM):

C67-20..... Sampling and Testing Brick and Structural Clay Tile.

C140/C140M-20a..... Sampling and Testing Concrete Masonry Units and Related Units.

C1371-15 ..... Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.

C1549-16 ..... Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.

D1876-08(2015)e1 ..... Peel Resistance of Adhesives (T-Peel Test).

D4263-83(2018) ..... Indicating Moisture in Concrete by the Plastic Sheet Method.

D4434/D4434M-15..... Poly(Vinyl Chloride) Sheet Roofing.

D6878/D6878M-13..... Thermoplastic Polyolefin Based Sheet Roofing.

E408-13..... Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

E1918-16..... Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.

E1980-11(2019) ..... Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

F. Cool Roof Rating Council (CRRC):

1-20 ..... Product Rating Program.

G. National Roofing Contractors Association (NRCA):

Manual-19 ..... The NRCA Roofing Manual: Membrane Roofing Systems.

H. U.S. Department of Agriculture (USDA):

BioPreferred® Program Catalog.

I. UL LLC (UL):

580-06 ..... Tests for Uplift Resistance of Roof Assemblies.

1897-20 ..... Uplift Tests for Roof Covering Systems.

J. U.S. Department of Commerce National Institute of Standards and Technology (NIST):

DOC PS 1-19 ..... Structural Plywood.

DOC PS 2-18 ..... Performance Standard for Wood-Based Structural-Use Panels.

K. U.S. Environmental Protection Agency (EPA):

Energy Star ..... ENERGY STAR Program Requirements for Roof Products Version 3.0.

1.4 PREINSTALLATION MEETINGS

A. Conduct pre-installation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. Inspection and Testing Agency.
   c. Contractor.
   d. Installer.
   e. Manufacturer's field representative.
   f. Other installers responsible for adjacent and intersecting work, including roof deck, flashings, roof penetrations, roof accessories, utility penetrations.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Installation.
   f. Terminations.
   g. Transitions and connections to other work.
   h. Inspecting and testing.

i. Other items affecting successful completion.

j. Pullout test of fasteners.

k. Material storage, including roof deck load limitations.

3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Roof membrane layout.
2. Roofing membrane fastener pattern and spacing.
3. Roofing membrane seaming and joint details.
4. Roof membrane penetration details.
5. Base flashing and termination details.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Minimum fastener pullout resistance.
3. Installation instructions.
4. Warranty.

D. Samples:

1. Roofing Membrane: 150 mm (6 inch) square.
2. Base Flashing: 150 mm (6 inch) square.
3. Fasteners: Each type.
4. Roofing Membrane Seam: 300 mm (12 inches) square.

E. Sustainable Construction Submittals:

1. Solar Reflectance Index (SRI) for roofing membrane.
2. Biobased Content:
   a. Show type and quantity for each product.
3. Low Pollutant-Emitting Materials:
   a. Show volatile organic compound types and quantities.
4. Energy Star label for roofing membrane.

F. Certificates: Certify products comply with specifications.

1. Fire and windstorm classification.
2. Energy performance requirements.

G. Qualifications: Substantiate qualifications comply with specifications.

1. Installer, including supervisors with project experience list.
2. Manufacturer's field representative with project experience list.

H. Field quality control reports.

I. Temporary protection plan. Include list of proposed temporary materials.

J. Operation and Maintenance Data:

1. Maintenance instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Approved by roofing system manufacturer as installer for roofing system with specified warranty.
2. Regularly installs specified products.
3. Installed specified products with satisfactory service on five similar installations for minimum five years.
   a. Project Experience List: Provide contact names and addresses for completed projects.
4. Employs full-time supervisors experienced installing specified system and able to communicate with Contracting Officer's Representative and installer's personnel.

B. Manufacturer's Field Representative:

1. Manufacturer's full-time technical employee or independent roofing inspector.
2. Individual certified by Roof Consultants Institute as Registered Roof Observer.

1.7 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.8 STORAGE AND HANDLING

A. Comply with NRCA Manual storage and handling requirements.

B. Store products indoors in dry, weathertight facility.

C. Store adhesives according to manufacturer's instructions.

D. Protect products from damage during handling and construction operations.

E. Products stored on the roof deck must not cause permanent deck deflection.

1.9 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 4 degrees C (40 degrees F) for minimum 48 hours before installation.
2. Weather Limitations: Install roofing only during dry current and forecasted weather conditions.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant roofing system against material and manufacturing defects and agree to repair any leak caused by a defect in the roofing system materials or workmanship of the installer.

1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Roofing System: Thermoplastic Polyolefin (TPO) sheet roofing adhered to roof deck.

2.2 SYSTEM PERFORMANCE

A. Design roofing system complying with specified performance:
   1. Load Resistance: ASCE/SEI 7; Design criteria: as indicated on Drawings.
   2. Energy Performance:
      a. EPA Energy Star Listed for low-slope roof products.
      b. ASTM E1980; Minimum 78 Solar Reflectance Index (SRI).
      c. CRRC-1; Minimum 0.70 initial solar reflectance and minimum 0.75 emissivity.
      d. Three-Year Aged Performance: Minimum 0.55 solar reflectance tested according to ASTM C1549 or ASTM E1918, and minimum 0.75 thermal emittance tested according to ASTM C1371 or ASTM E408.
         1) Where tested aged values are not available:
            a) Calculate compliance adjusting initial solar reflectance according to ASHRAE 90.1.
            b) Provide roofing system with minimum 64 three-year aged Solar Reflectance Index calculated according to ASTM E1980 with 12 W/square meter/degree K (2.1 BTU/hour/square foot) convection coefficient.

2.3 PRODUCTS - GENERAL

A. Provide roof system components from one manufacturer.

B. Sustainable Construction Requirements:
   1. Solar Reflectance Index: 78 minimum.
   2. Biobased Content: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to www.biopreferred.gov.
   3. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
      a. Non-flooring adhesives and sealants.

2.4 TPO ROOFING MEMBRANE

1. TPO Sheet: ASTM D6878/D6878M, internally fabric or scrim reinforced, 1.5 mm (60 mils) thick, with fabric backing .

2.5 MEMBRANE ACCESSORY MATERIALS

A. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.

B. Factory Formed Flashings: Inside and outside corners, pipe boots, and other special flashing shapes to minimize field fabrication.

C. Bonding Adhesive: Manufacturer's standard, water based.

D. Metal Termination Bars: Manufacturer's standard, stainless-steel or aluminum, 25 mm wide by 3 mm thick (1-inch wide by 1/8 inch thick) factory drilled for fasteners.

E. Battens: Manufacturer's standard, galvannealed or galvanized steel sheet, 25 mm wide by 1.3 mm thick (1-inch wide by 0.05 inch thick), factory punched for fasteners.

F. Fasteners: Manufacturer's standard coated steel with metal or plastic plates, to suit application.

G. Primers, Sealers, T-Joint Covers, Lap Sealants, and Termination Reglets: As specified by roof membrane manufacturer.

H. Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.

2.6 ACCESSORIES

A. Temporary Protection Materials:

1. Expanded Polystyrene (EPS) Insulation: ASTM C578.
2. Plywood: NIST DOC PS 1, Grade CD Exposure 1.
3. Oriented Strand Board (OSB): NIST DOC PS 2, Exposure 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine and verify substrate suitability with roofing Installer and roofing inspector present.

1. Verify roof penetrations are complete, secured against movement.
2. Verify roof deck is adequately secured to resist wind uplift.
3. Verify roof deck is clean, dry, and in-plane ready to receive roofing system.

B. Correct unsatisfactory conditions before beginning roofing work.

3.2 PREPARATION

A. Complete roof deck construction before beginning roofing work:

1. Curbs, blocking, edge strips, nailers, cants, and other components to which insulation, roofing, and base flashing is attached in place ready to receive insulation and roofing.
2. Coordinate roofing membrane installation with flashing work and roof insulation work so insulation and flashing are installed concurrently to permit continuous roofing operations.
3. Complete installation of flashing, insulation, and roofing in same day except for the area where temporary protection is required when work is stopped for inclement weather or end of work day.

B. Dry out surfaces that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates, only.

C. Broom clean roof decks. Remove dust, dirt and debris.

D. Remove projections capable of damaging roofing materials.

3.3 TEMPORARY PROTECTION

A. Install temporary protection consisting of a temporary seal and water cut-offs at the end of each day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent.

B. Install temporary cap flashing over top of base flashings where permanent flashings are not in place to protect against water intrusion into roofing system. Securely anchor in place to prevent blow off and damage by construction activities.

C. Temporarily seal exposed insulation surfaces within roofing membrane.

1. Apply temporary seal and water cut off by extending roofing membrane beyond insulation and securely embedding edge of the roofing membrane in 6 mm (1/4 inch) thick by 50 mm (2 inches) wide strip of temporary closure sealant. Weight roofing membrane edge with sandbags, to prevent displacement; space sandbags maximum 2400 mm (8 feet) on center.
2. Direct water away from work. Provide drainage, preventing water accumulation.
3. Check daily to ensure temporary seal remains watertight. Reseal open areas and weight down.

D. Before the work resumes, cut off and discard portions of roof membrane in contact with temporary seal.

1. Cut minimum 150 mm (6 inches) back from sealed edges and surfaces.

E. Remove sandbags and store for reuse.

3.4 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Comply with NRCA Manual installation requirements.

C. Comply with UL 580 and UL 1897 for uplift resistance.

D. Do not allow membrane and flashing to contact surfaces contaminated with asphalt, coal tar, oil, grease, or other substances incompatible with TPO.

3.5 ROOFING INSTALLATION

A. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.

B. Begin installation at the low point of the roof and work towards the high point. Lap membrane shingled in water flow direction.

C. Position the membrane free of buckles and wrinkles.

D. Roll membrane out; inspect for defects as membrane is unrolled. Remove defective areas:

1. Lap edges and ends of sheets 50 mm (2 inches) or more as recommended by the manufacturer.

2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434/D4434M.
3. Check seams to ensure continuous adhesion and correct defects.
4. Finish seam edges with beveled bead of lap sealant.
5. Finish seams same day as membrane is installed.
6. Anchor membrane perimeter to roof deck or parapet wall as indicated on drawings.
7. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.
8. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (4 inches) beyond cut.
   a.

E. Adhered System:
1. Apply bonding adhesive in quantities required by roof membrane manufacturer.
2. Fold sheet back on itself, clean and coat the bottom side of the membrane and the top of substrate with adhesive. Do not coat the lap joint area.
3. After adhesive has set according to adhesive manufacturer's instruction, roll roofing membrane into adhesive minimizing voids and wrinkles.
4. Repeat for other half of sheet.

3.6 FLASHING INSTALLATION

A. Install flashings same day as roofing membrane is installed. When flashing cannot be completely installed in one day, complete installation until flashing is watertight and provide temporary covers or seals.

3.7 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
1. Fastener Pull Out Tests: ANSI/SPRI FX-1; one test for every 230 square meter (2,500 square feet) of deck. Perform tests for each combination of fastener type and roof deck type before installing roof insulation.
   a. Test at locations selected by Contracting Officer's Representative.
   b. Do not proceed with roofing work when pull out resistance is less than manufacturer's required resistance.
   c. Test Results:
      1) Repeat tests using different fastener type or use additional fasteners achieve pull out resistance required to meet specified wind uplift performance.
      2) Patch cementitious deck to repair areas of fastener tests holes.
2. Examine and probe roofing membrane and flashing seams in presence of Contracting Officer's Representative and Manufacturer's field representative.

3. Probe seams to detect marginal bonds, voids, skips, and fishmouths.
4. Cut 100 mm (4 inch) wide by 300 mm (12 inch) long samples through seams where directed by Contracting Officer's Representative.
5. Cut one sample for every 450 m (1500 feet) of seams.
6. Cut samples perpendicular to seams.
7. Failure of samples to pass ASTM D1876 test will be cause for rejection of work.
8. Repair areas where samples are taken and where marginal bond, voids, and skips occur.
9. Repair fishmouths and wrinkles by cutting to lay flat. Install patch over cut area extending 100 mm (4 inches) beyond cut.

B. Manufacturer Services:
1. Inspect initial installation, installation in progress, and completed work.
2. Issue supplemental installation instructions necessitated by field conditions.
3. Prepare and submit inspection reports.
4. Certify completed installation complies with manufacturer's instructions and warranty requirements.

3.8 CLEANING

A. Remove excess adhesive before adhesive sets.
B. Clean exposed roofing surfaces. Remove contaminants and stains to comply with specified solar reflectance performance.

3.9 PROTECTION

A. Protect roofing system from traffic and construction operations.
1. Protect roofing system when used for subsequent work platform, materials storage, or staging.
2. Distribute scaffolding loads to exert maximum 50 percent roofing system materials compressive strength.

B. Loose lay temporary insulation board overlaid with plywood or OSB.
1. Weight boards to secure against wind uplift.

C. Remove protective materials immediately before acceptance.
D. Repair damage.

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SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae, drainage specialties, and formed expansion joint covers are specified in this section.

1.2 RELATED WORK

A. Section 07 54 23 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING: Membrane base flashings and stripping.

B. Section 07 71 00 ROOF SPECIALTIES: Manufactured flashing, copings, roof edge metal, and fasciae.

C. Section 07 92 00, JOINT SEALANTS: Joint Sealants.

D. Section 09 91 00, PAINTING: Paint materials and application.

1.3 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. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.

B. Aluminum Association (AA):

AA-C22A41 ..... Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick

AA-C22A42 ..... Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick

AA-C22A44 ..... Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish

C. American National Standards Institute/Single-Ply Roofing Institute/Factory Mutual (ANSI/SPRI/FM):

4435/ES-1-11 ..... Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

D. American Architectural Manufacturers Association (AAMA):

AAMA 620-02..... Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum

AAMA 621-02..... Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

E. ASTM International (ASTM):

A240/A240M-20 ..... Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A653/A653M-20 ..... Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process

B32-08(2014) ..... Solder Metal

B209-14..... Aluminum and Aluminum-Alloy Sheet and Plate

B370-12(2019) ..... Copper Sheet and Strip for Building Construction

D173/D173M-03(2018) ..... Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing

D412-16 ..... Vulcanized Rubber and Thermoplastic Elastomers-Tension

D1187/D1187M-97(2018) ..... Asphalt Base Emulsions for Use as Protective Coatings for Metal

D1784-20 ..... Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

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

D4586/D4586M-07(2018) ..... Asphalt Roof Cement, Asbestos Free

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

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

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

H. Federal Specification (Fed. Spec):

A-A-1925A..... Shield, Expansion; (Nail Anchors)

UU-B-790A..... Building Paper, Vegetable Fiber

I. International Code Commission (ICC): International Building Code, Current Edition

1.4 PERFORMANCE REQUIREMENTS

A. Wind Uplift Forces: Resist the following forces as indicated on Drawings.

B. Wind Design Standard: Fabricate and install copings and roof-edge flashings tested per ANSI/SPRI/FM ES-1 to resist design pressure indicated on Drawings.

1.5 SUBMITTALS

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

B. Shop Drawings: For all specified items, including:

1. Flashings
2. Copings
3. Gutter and Conductors

C. Manufacturer's Literature and Data: For all specified items, including:

1. Two-piece counterflashing
2. Thru wall flashing
3. Nonreinforced, elastomeric sheeting
4. Copper clad stainless steel
5. Copper covered paper

D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

A. Copper ASTM B370, cold-rolled temper.

B. Copper Covered Paper: Fabricated of electro-deposit pure copper sheets ASTM B 370, bonded with special asphalt compound to both sides of creped, reinforced building paper, UU-B-790, Type I, style 5, or to a three ply sheet of asphalt impregnated crepe paper. Grooves running along the width of sheet.

C. Aluminum Sheet: ASTM B209, alloy 3003-H14.

D. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

2.2 FLASHING ACCESSORIES

A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.

B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m²(6 pounds/100 square feet).

C. Bituminous Paint: ASTM D1187, Type I.

D. Fasteners:

1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy.
2. Nails:
   a. Minimum diameter for copper nails: 3 mm (0.109 inch).
   b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
   c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
   d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
3. Rivets: Not less than 3 mm (1/8 inch) diameter.

4. Expansion Shields: Fed Spec A-A-1925A.

E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.

F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.

G. Roof Cement: ASTM D4586.

2.3 SHEET METAL THICKNESS

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:

B. Concealed Locations (Built into Construction):

1. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).
2. Stainless steel: 0.25 mm (0.010 inch) thick.
3. Copper clad stainless steel: 0.25 mm (0.010 inch) thick.

C. Exposed Locations:

1. Copper: 0.4 Kg (16 oz).
2. Stainless steel: 0.4 mm (0.015 inch).
3. Copper clad stainless steel: 0.4 mm (0.015 inch).

D. Thickness of aluminum or galvanized steel is specified with each item.

2.4 FABRICATION, GENERAL

A. Jointing:

1. In general, copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
3. Joints shall conform to following requirements:
   a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
   b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
   c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
4. Flat and lap joints shall be made in direction of flow.
5. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:
   a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
   b. Wire brush to produce a bright surface before soldering lead coated copper.
   c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.

d. Completely remove acid and flux after soldering is completed.

B. Cleats:

1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

C. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 0.6 Kg (24 ounce) copper and 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1 Kg (32 oz) copper and 1.6 mm (0.0625 inch) thick aluminum.

D. Drips:

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

E. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC, current edition.

F. Metal Options:
   1. Where options are permitted for different metals use only one metal throughout.
   2. Where copper copings and flashings will carry water onto cast stone, stone, or architectural concrete, or stainless steel.

2.5 FINISHES

A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.
C. Finish exposed metal surfaces as follows, unless specified otherwise:
   1. Copper: Mill finish.
   2. Aluminum:
      a. Fluorocarbon Finish: AAMA 620, high performance organic coating.

2.6 THROUGH-WALL FLASHINGS

A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
   1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
   2. Fabricate so keying nests at overlaps.
B. Window Sill Flashing and Lintel Flashing:
   1. Use either copper, copper clad stainless-steel plane flat sheet, or nonreinforced elastomeric sheeting, bituminous coated copper, or copper covered paper.
   2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
   3. Turn up back edge as shown.
   4. Form exposed portion with drip as specified or receiver.

2.7 BASE FLASHING

A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
   1. Use either copper, or stainless steel, thickness specified unless specified otherwise.
   2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.
   3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
   4. Use either copper, or stainless steel at pipe flashings.
B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).

C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.

D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.

E. Pipe Flashing: (Other than engine exhaust or flue stack)

1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
   a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
   b. Allow for loose fit around and into the pipe.
4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
   a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
   b. Allow for loose fit around pipe.

2.8 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. Either copper or stainless steel, unless specified otherwise.

B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:

1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
4. Manufactured assemblies may be used.
5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.

C. One-piece Counterflashing:

1. Back edge turned up and fabricate to lock into reglet in concrete.
2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).

D. Surface Mounted Counterflashing; one or two piece:

1. Use at existing or new surfaces where flashing cannot be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers

between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.

3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

E. Pipe Counterflashing:

1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
2. Fabricate 100 mm (4 inch) over lap at end.
3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
4. Use stainless steel bolt on draw band tightening assembly.
5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

F. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

2.9 HANGING GUTTERS

A. Fabricate gutters of not less than the following:

1. 24 oz copper.

B. Fabricate hanging gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.

C. Building side of gutter shall be not less than 38 mm (1 1/2 inches) higher than exterior side.

D. Gutter Bead: Stiffen outer edge of gutter by folding edge over approximately 19 mm (3/4 inch) toward roof and down approximately19 mm (3/4 inch) unless shown otherwise.

E. Gutter Spacers:

1. Fabricate of same material and thickness as gutter.
2. Fabricate 25 mm (one inch) wide strap and fasten to gutters not over 900 mm (36 inches) on center.
3. Turn back edge up 25 mm (one inch) and lap front edge over gutter bead.
4. Rivet and solder to gutter except rivet and seal to aluminum.

F. Outlet Tubes:

1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters extend into the conductor 75 mm (3 inch). Flange upper end of outlet tube 13 mm (1/2 inch).
2. Lock and solder longitudinal seam
3. Solder tube to gutter.
4. Fabricate basket strainers of same material as gutters.

G. Gutter Brackets:
   1. Fabricate of same metal as gutter. Use the following:
      a. 6 by 25 mm (1/4 by 1 inch) copper.
   2. Fabricate to gutter profile.
   3. Drill two 5 mm (3/16 inch) diameter holes in anchor leg for countersunk flat head screws.

2.10 CONDUCTORS (DOWNSPOUTS)

A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long [with 19 mm (3/4 inch) wide flat locked seams].
   1. Fabricate open face channel shape with hemmed longitudinal edges.
B. Fabricate elbows by mitering, riveting, and soldering except seal aluminum in lieu of solder. Lap upper section to the inside of the lower piece.
C. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (one inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual for rectangular and round shapes.
D. Conductor Heads:
   1. Fabricate of same material as conductor.
   2. Fabricate conductor heads to not less than 250 mm (10 inch) wide by 200 mm (8 inch) deep by 200 mm (8 inches) from front to back.
   3. Form front and side edges channel shape not less than 13 mm (1/2 inch) wide flanges with edge hemmed.
   4. Slope bottom to sleeve to conductor or downspout at not less than 60 degree angle.
   5. Extend wall edge not less than 25 mm (one inch) above front edge.
   6. Solder joints for water tight assembly.
   7. Fabricate outlet tube or sleeve at bottom not less than 50 mm (2 inches) long to insert into conductor.

2.11 REGLETS

A. Fabricate reglets of one of the following materials:
   1. 0.4 Kg (16 ounce) copper.
   2. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
   3. Plastic coated extruded aluminum, not less than 1.4 mm (0.055 inch) thick prefilled with butyl rubber sealer and complete with plastic wedges inserted at 1000 mm (40 inches) on centers.
   4. Plastic, ASTM D1784, Type II, not less than 2 mm (0.075 inch) thick.
B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.
C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.

D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.

E. Fabricate mitered corners, fittings, and special shapes as may be required by details.

F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

2.12 SCUPPERS

A. Fabricate scuppers with minimum of 100 mm (4 inch) wide flange.

B. Provide flange at top on through wall scupper to extend to top of base flashing.

C. Fabricate exterior wall side to project not less than 13 mm (1/2 inch) beyond face of wall with drip at bottom outlet edge.

D. Fabricate not less than 100 mm (4 inch) wide flange to lap behind gravel stop fascia.

E. Fabricate exterior wall flange for through wall scupper not less than 25 mm (one inch) wide on top and sides with edges hemmed.

F. Fabricate gravel stop bar of 25 mm x 25 mm (one by one inch) angle strip soldered to bottom of scupper.

G. Fabricate scupper not less than 200 mm (8 inch) wide and not less than 125 mm (5 inch) high for through wall scupper.

H. Solder joints watertight.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.

7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
    a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    b. Paint dissimilar metal with a coat of bituminous paint.
    c. Apply an approved caulking material between aluminum and dissimilar metal.
15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
17. Bitumen Stops:
    a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
    b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

3.2 THROUGH-WALL FLASHING

A. General:
1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.

2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
    a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).

B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.

C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).

D. Window Sill Flashing:

1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
2. Turn back edge up to terminate under window frame.
3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.
4.

3.3 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:
   1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
   2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
   3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
   4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
   5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
   6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:
   1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
   2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
   3. Where flashing is surface mounted on flat surfaces.
      a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
         1) Locate fasteners in masonry mortar joints.
         2) Use screws to sheet metal or wood.
      b. Fill joint at top with sealant.
   4. Where flashing or hood is mounted on pipe.
      a. Secure with draw band tight against pipe.
      b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
      c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:

1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Surface applied type receiver:
   a. Secure to face construction in accordance, with manufacturers' instructions.
   b. Completely fill space at the top edge of receiver with sealant.
3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

E. When counter flashing is a component of other flashing install as shown.

3.4 REGLETS

A. Install reglets in a manner to provide a watertight installation.

B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.

C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:
   1. Coordinate reglets for anchorage into concrete with formwork construction.
   2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.5 COPINGS

A. General:
   1. On walls topped with a wood plank, install a continuous edge strip on the front // and rear // edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
   2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
   3. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.

B. Aluminum Coping:
   1. Install with 6 mm (1/4 inch) joint between ends of coping sections.
   2. Install joint covers, centered at each joint, and securely lock in place.

3.6 CONDUCTORS (DOWNSPOUTS)

A. Where scuppers discharge into downspouts install conductor head to receive discharge with back edge up behind drip edge of scupper. Fasten and seal joint. Sleeve conductors to gutter outlet tubes and fasten joint and joints between sections.

B. Set conductors plumb and clear of wall, and anchor to wall with two anchor straps, located near top and bottom of each section of conductor. Strap at top shall be fixed to downspout, intermediate straps and strap at bottom shall be slotted to allow not less than 13 mm (1/2 inch) movement for each 3000 mm (10 feet) of downspout.

C. Install elbows, offsets and shoes where shown and required. Slope not less than 45 degrees.

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SECTION 07 71 00
ROOF SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies copings and gravel stops.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 07 21 13, THERMAL INSULATION: General Insulation.

C. Section 07 22 00, ROOF AND DECK INSULATION: Rigid Insulations for Roofing.

D. Section 07 92 00, JOINT SEALANTS: Sealant Material and Installation.

1.3 QUALITY CONTROL

A. Provide roof accessories that products of manufacturers regularly engaged in producing the kinds of products specified.

B. For each accessory type provide products made by the same manufacturer.

C. Assemble each accessory to the greatest extent possible before delivery to the site.

D. Provide each accessory with FM approval listing for class specified.

1.4 PERFORMANCE REQUIREMENTS

A. Provide roof accessories that withstand exposure to weather and resist thermal movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, or installation.

B. Provide roof accessories listed in FM Approvals “RoofNav” and approved for windstorm classification Class 1-120. Identify materials with FM Approval markings.

C. Manufacture and install roof accessories to allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

1. Provide clips that resist rotation and avoid shear stress as a result of thermal movements.
2. For design purposes, base provisions for thermal movement on assumed ambient temperature (range) from minus 18 degrees C (0 degrees F), ambient to 82 degrees C (180 degrees F).

1.5 SUBMITTALS

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

B. Sustainable Design Submittals, as described below:

1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.

C. Samples: Representative sample panel of color-anodized aluminum not less than 101 x 101 mm (4 x 4 inches), except extrusions are to be of a width not less than section to be used. Submit sample that shows coating with integral color and texture. Include manufacturer's identifying label.

D. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.

E. Manufacturer's Literature and Data: Each item specified.

F. Certificates: Stating that aluminum has been given specified thickness of anodizing.

1.6 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

A240/A240M-20 ..... Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A653/A653M-20 ..... Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

A666-15..... Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

B209-14..... Aluminum and Aluminum Alloy-Sheet and Plate

B209M-14..... Aluminum and Aluminum Alloy-Sheet and Plate (Metric)

B221-14..... Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

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

B32-08(2014) ..... Solder Metal

B370-12(2019) ..... Copper Sheet and Strip for Building Construction

B882-10(2018) ..... Pre-Patinated Copper for Architectural Applications

C612-14(2019) ..... Mineral Fiber Block and Board Thermal Insulation

D1187/D1187M-97(2018) ..... Asphalt-Base Emulsions for Use as Protective Coatings for Metal

D1970/D1970M-20..... Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

D226/D226M-17..... Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

D4869/D4969M-16a..... Asphalt-Saturated Organic Felt Underlayment Used In Steep Slope Roofing

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

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

D. American Architectural Manufacturers Association (AAMA):

2605-11 .....High Performance Organic Coatings on Architectural Extrusions and Panels.

611-14 .....Anodized Architectural Aluminum

E. FM Global (FM):

RoofNav .....Approved Roofing Assemblies and Products

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221M (B221).

B. Aluminum Sheet: ASTM B209M (B209).

C. Galvanized Sheet Steel: ASTM A653/A653M; G-90 coating.

D. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

E. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

F. Recycled Content of Metal Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

G. Insulation: ASTM C612, Class 1 or 2.

H. Asphalt Coating: ASTM D1187, Type I, quick setting.

2.2 UNDERLAYMENT

A. Self-Adhering Modified Bitumen Underlayment:

1. Provide self-adhering modified bitumen membrane underlayment material in compliance with ASTM D1970/D1970M, suitable for use as underlayment for metal copings.
2. Provide membrane resistant to cyclical elevated temperatures for extended period of time in high heat service conditions (stable after testing at 116 degrees C (240 degrees F)).
3. Provide membrane with integral non-tacking top surface of polyethylene film or other surface material to serve as separator between bituminous material and metal products to be applied above.
4. Provide primer.

B. Felt Underlayment: Provide No. 30 asphalt saturated organic, non-perforated felt underlayment in compliance with ASTM D226/D226M, Type II, or ASTM D4869/D4869M.

C. Slip Sheet: Provide 0.24 kg per square meter (5 pounds per 100 sf) rosin sized unsaturated building paper for slip sheet.

2.3 SOLDER

A. Copper Solder conforming to ASTM B32, lead-free solder.

2.4 COPINGS

A. Fabricate of aluminum sheet not less than 2 mm (0.08inch) thick; 16 oz. copper

B. Turn outer edges down each face of wall as shown on construction documents.

C. Maximum lengths of 3.05 M (10 feet).

D. Shop fabricate external and internal corners as one-piece assemblies with not less than 305 mm (12 inch) leg lengths.

E. Provide 101 mm (4 inch) wide 0.81 mm (0.032 inch) thick watertight joint covers.

F. Provide anchor gutter bar of 0.81 mm (0.032 inch) thick with anchor holes formed for underside of joint.

G. Provide concealed guttered splice plate of 0.81 mm (0.032 inch) thick with butyl or other resilient seal strips anchored to splice plate for underside of joint. Use galvanized steel anchor plate providing compression spring anchoring of coping cover.

H. Finish: Three-coat fluoropolymer Color anodic as specified.

I. SPEC WRITER NOTE: Detail gravel stop and fascias. If roof is ballasted extend vertical curb to be above paver/gravel surface. Where protective membrane insulation or 1-90 design occurs use system that clamps insulation or pavers down. Provide scuppers at water line for overflow protection when stop exceeds 25 mm (1 inch) in height above roof line.

2.5 EXTRUDED ALUMINUM GRAVEL STOPS AND FASCIAS

A. Fabricate of aluminum not less than 2 mm (0.078 inch) thick.

B. Turn fascia down face of wall and up above roof as shown in construction documents.

C. Maximum lengths of 3.05 M (10-feet).

D. Shop fabricate external and internal corners as one (1)-piece assemblies with not less than 305 mm (12 inch) leg lengths.

E. Provide 101 mm (4 inch) wide 2 mm (0.078 inch) thick watertight joint covers with 152 mm (6 inch) wide 0.8 mm (0.030 inch) thick underside joint flashing.

F. Finish: Three-coat fluoropolymer Color as specified.

2.6 FINISH:

A. In accordance with NAAMM AMP 500-505.

B. Copper Sheet Finishes: Non-Patinated Finish: Mill finish. Finish for replacing existing metal exterior finishes.

C. Fluoropolymer Finishes: High performance organic coating. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and top color coat.
2. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.013 mm (0.5 mil).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, areas, and conditions, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

C. Underlayment Installation:

1. Self-Adhering Sheet Underlayment:
   a. Apply primer as required by manufacturer.
   b. Comply with temperature restrictions of underlayment manufacturer for installation.
   c. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 152 mm (6 inches) staggered 610 mm (24 inches) between courses.
   d. Overlap side edges not less than 89 mm (3-1/2 inches). Roll laps with roller.
   e. Cover underlayment within 14 days.
   f. Apply continuously under copings and roof-edge fascias and gravel stops.
   g. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.
2. Slip Sheet:
   a. Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties.
   b. Apply in shingle fashion to shed water, with lapped joints of not less than 50 mm (2 inches).

D. Install roof accessories where indicated in construction documents.

E. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise. Provide fasteners suitable for application, for metal types being secured and designed to meet performance requirements.

F. Where soldered joints are required, clean surfaces to be soldered, removing oils and foreign matter.

1. Pre-tin edges of sheets to be soldered to a width of 38 mm (1-1/2 inches).
2. Reduce pre-tinning where pre-tinned surface would show in completed work.
3. Tin edges of uncoated copper sheets using solder for copper.
4. Do not use torches for soldering.
5. Heat surfaces to receive solder and flow solder into joint.
6. Fill joint completely.
7. Completely remove flux and spatter from exposed surfaces.

G. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.

H. Comply with section 07 92 00, JOINT SEALANTS to install sealants where required by manufactures installation instructions.

I. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.

J. Gravel Stops and Fascias:

1. Install gravel stops and fascia with butt joints with approximately 6 mm (1/4 inch) space for expansion.
2. Over each joint provide cover plates of sheet aluminum, complete with concealed sheet aluminum flashing, centered under each joint.
3. Provide lap cover plates and concealed flashing over the gravel stop and fascia not less than 101 mm (4 inches).
4. Extend concealed flashing over built-up roofing, embed in roof cement and turn down over face of blocking at roof edge.

K. Aluminum Coping:

1. Install sections of coping with approximately 6 mm (1/4-inch) space between ends of sections.
2. Center joint gutter bar and covers at joints and lock in place.
3. When snap-on system is installed ensure front and back edges are locked in place.

L. Expansion Joint Covers:

1. Install to terminate base flashing 203 mm (8 inches) above roof.
2. Install moisture seals to drain water to outlets that do not permit water to enter building.
3. Provide stainless steel screws when exposed.
4. Three piece assembly:
   a. Install curb section with screws to wood blocking, allowing 6 mm (1/4 inch) at butt joints between sections with splice plate at joint.
   b. Install cant to wood blocking by nailing along horizontal flange every 152 mm (6 inches), with galvanized roofing nails 25 mm (1 inch) long.
   c. After completion of base flashing install cap flashing and compression clamp and fasten to the curb or metal cant with stainless steel self-tapping screws with neoprene washers under head spaced approximately 457 mm (18 inches) on center.
   d. Install expansion joint cover with a 6 mm (1/4 inch) wide end joints.
   e. Install over end joint a cover plate complete with concealed aluminum flashing, centered under each joint. Fabricate flashing to lap cover not less than 101 mm (4 inches.
5. Two piece assembly:
   a. Install curb section with screws allowing 6 mm (1/4 inch) space at end joints with splice plate at joint.
   b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.

c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 610 mm (24 inches) on center.

d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 101 mm (4 inches).

3.2 PROTECTION OF ALUMINUM

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two (2) coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on one (1) side.

B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two (2) coats of asphalt coating.

3.3 ADJUSTING

A. Adjust expansion joints to close tightly and be watertight; insuring maximum allowance for building movement.

3.4 PROTECTION

A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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SECTION 07 81 00
APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies spray-applied cementitious coverings to provide fire resistance to interior structural steel members shown. Sprayed-applied mineral fiber fireproofing is not permitted.

1.2 RELATED WORK:

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

1.3 SUBMITTALS:

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

B. Sustainable Design Submittals, as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Installer qualifications.

D. Testing laboratory accreditations.

E. Manufacturer's Literature and Data:

1. Manufacturer's complete and detailed application instructions and specifications.
2. Manufacturer's repair and patching instructions.

F. Certificates:

1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
   a. List thickness and density of material required to meet fire ratings.
   b. Accompanied by complete test report and test record.
2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.

G. Miscellaneous:

1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing.
2. Manufacturer's written approval of completed installation.
3. Manufacturer's written approval of the applicators of fireproofing material.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver to job-site in sealed containers marked and labeled to show manufacturer's name and brand and UL certification markings of compliance with the specified requirements.

B. Remove damaged or opened containers from the site.

C. Store the materials off the ground, under cover, away from damp surfaces.

D. Keep dry until ready for use.

E. Remove materials that have been exposed to water before installation from the site.

1.4 FIELD CONDITIONS:

A. Temperature: Do not apply fireproofing when substrate or ambient temperature is below 4 degrees C (40 degrees F) unless temporary protection and heat are provided to maintain temperature at or above stated value during application and for 24 hours before and after application.

B. Humidity: Maintain relative humidity levels within limits recommended by fireproofing manufacturer.

C. Ventilation: Provide ventilation to properly dry the fireproofing after application. Provide a minimum of four (4) air exchanges per hour by forced air circulation. When permitted by Contracting Officer Representative (COR), ventilate by natural circulation.

1.5 QUALITY ASSURANCE:

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer’s products according to specified requirements. Submit manufacturer’s certification that each installer is trained and qualified to install the specified fireproofing. Submit evidence that each installer has a minimum of three (3) years’ experience and a minimum of four (4) installations using the specified fireproofing.

B. Testing Laboratory Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority. Submit a copy of the Certificate of Accreditation and Scope of Accreditation.

C. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.

D. Manufacturer's inspection and approval of surfaces to receive fireproofing.

E. Manufacturer's approval of fireproofing applications.

F. Manufacturer's approval of completed installation.

G. Manufacturer's representative is to observe and advise at the commencement of application, and is required to visit the site as required thereafter for the purpose of ascertaining proper application.

H. Pre-Application Test Area.

1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 4.5 m (15 feet) of beam and deck.
   a. Apply to one (1) column.
   b. Apply for the hourly ratings required in the construction documents.
2. Install in location selected by the COR, for approval by the representative of the fireproofing material manufacturer and the COR.
3. Perform Bond test for cohesive and adhesive strength in accordance with ASTM E736 for each applied fireproofing design used.

4. Perform density test in accordance with ASTM E736 for each applied fireproofing design used.
5. Do not proceed in other areas until installation of test area has been completed and approved.
6. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

1.6 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):

C841-03(R2013) .....Installation of Interior Lathing and Furring
C847-14 .....Metal Lath
E84-14.....Surface Burning Characteristics of Building Materials
E119-12a.....Fire Tests of Building Construction and Materials
E605-93(R2011).....Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members
E736-00(R2011).....Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
E759-92(R2011).....The Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
E760-92(R2011).....Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members
E761-92(R2011).....Compressive Strength of Fire-Resistive Material Applied to Structural Members
E859-93(R2011).....Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members
E937-93(R2011).....Corrosion of Steel by Sprayed Fire-Resistive Material Applied to Structural Members
E1042-02(R2014).....Acoustically, Absorptive Materials Applied by Trowel or Spray.
G21-13 .....Determining Resistance of Synthetic Polymeric Materials to Fungi

C. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory...Latest Edition including Supplements

D. Warnock Hersey (WH):

Certification Listings .....Latest Edition

E. Factory Mutual System (FM):

Approval Guide .....Latest Edition including Supplements

F. Environmental Protection Agency (EPA):

40 CFR 59(2014) .....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 SPRAYED-ON FIREPROOFING:

A. ASTM E1042, Class (a), Category A.

1. Factory mixed cementitious materials with approved aggregate.

B. Materials containing asbestos are not permitted.

C. Fireproofing characteristics when applied in the thickness and density required to achieve the fire-rating specified.

	Characteristic	Test	Results
1.	Deflection	ASTM E759	No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3 m (10 ft.)
2.	Corrosion-Resistance	ASTM E937	No promotion of corrosion of steel.
3.	Bond Impact	ASTM E760	No cracking, spalling, or delamination.
4.	Cohesion/Adhesion (Bond Strength)	ASTM E736	Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf per sq. ft.) for protected areas. 19.15 kPa (400 lbf per sq. ft.) for exposed areas.
5.	Air Erosion	ASTM E859	Maximum gain weight of the collecting filter 0.27 gm per sq. meter (0.025 gm per sq. ft.).
6.	Compressive Strength	ASTM E761	Minimum compressive strength 48 kPa (1000 psf).
7.	Surface Burning Characteristics with adhesive and sealer to be used	ASTM E84	Flame spread 25 or less smoke developed 50 or less
8.	Fungi Resistance	ASTM G21	Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)

2.2 ADHESIVE:

A. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

2.3 SEALER:

A. Surface burning characteristics as specified for fireproofing material.

B. Fungus resistant.

C. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.

D. VOC content: Product to comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.

2.4 WATER:

A. Clean, fresh, and free from organic and mineral impurities.

B. pH of 6.9 to 7.1.

2.5 MECHANICAL BOND MATERIAL:

A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg per square meter (1.7 pounds per square yard) or as required, according to fire-resistance designs indicated and fire proofing manufacturer's written instructions.

B. Fasteners: ASTM C841.

C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachments.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.

B. Verify hangers, inserts and clips are installed before the application of fireproofing material.

C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.

D. Verify concrete work on steel decking and concrete encased steel is completed.

E. When applied in conjunction with roof structures or roof decks, verify that roofing, installation of rooftop HVAC equipment, and other related work are complete.

F. Verify temperature and enclosure conditions required by fire-proofing material manufacturer.

G. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond. Submit test report.

3.2 APPLICATION:

A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative, and are suitable to receive sprayed-on fireproofing.

B. Coordinate application of fireproofing material with other trades.

C. Cover other work and exterior openings subject to damage from fallout or overspray of fireproofing materials during application.

D. Application of Metal Lath:

1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
2. Apply to beam flanges 305 mm (12-inches) or more in width.
3. Apply to column flanges 406 mm (16-inches) or more in width.
4. Apply to beam or column web 406 mm (16-inches) or more in depth.
5. Tack weld or mechanically fasten on maximum of 305 mm (12-inch) center.
6. Lap and tie lath member in accordance with ASTM C841.

E. Mix and apply in accordance with manufacturer's instructions.
1. Mechanically control material and water ratios.
2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
4. Minimum ASTM E605 applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purlin or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms to be as follows:

F. Complete application is to be completed in one area. Inspection and approval by COR is required before removal of application equipment and proceeding with further work.

3.3 FIELD TESTS:

A. The applied fireproofing to be tested by a COR approved independent testing laboratory and paid for by the Contractor. Submit test reports documenting results of tests on the applied material in the project.

B. COR will select area to be tested in specific bays on each floor using a geometric grid pattern. Apply test sample every 929 square meters (10,000 square feet) of floor area or two (2) for each floor, whichever produces the greatest number of test areas.

C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test are not acceptable.

D. Areas showing less than required fireproofing characteristics are not suitable for the following field tests.
1. Test for cohesion/adhesion: ASTM E736.
2. Test for bond impact strength: ASTM E760.

3.4 PATCHING AND REPAIRING:

A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.

B. Perform corrective measures in accordance with fireproofing material manufacturer's recommendations.

1. Respray areas requiring additional fireproofing material to provide the required thickness, and replace dislodged or removed material.
2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.
3. Do not hand mix material.

C. Repair:

1. Respray test and rejected areas.
2. Patch fireproofing material which is removed or disturbed after approval.

D. Perform final inspection of sprayed areas after patching and repair.

3.6 SCHEDULE:

A. Apply fireproofing material in interior structural steel members and on underside of interior steel floor and roof decks , except on following surfaces:

1. Structural steel and underside of steel decks in elevator or dumbwaiter machine rooms.
2. Steel members in elevator hoist ways.
3. Areas used as air handling plenums.
4. Steel to be encased in concrete or designated to receive other type of fireproofing.

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SECTION 078123

INTUMESCENT FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes mastic and intumescent fire-resistive coatings.

B. Related Requirements:

1. Section 078100 "Applied Fireproofing" for sprayed fire-resistive materials (SFRM).
2. Section 099646 "Intumescent Painting" for intumescent paints that are fire retarding, but not fire resistive.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:

1. Extent of fireproofing for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of fireproofing after application.

C. Samples: For each exposed product and for each color and texture specified, [4 inches (102 mm) square in size.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of fireproofing.

C. Evaluation Reports: For fireproofing, from ICC-ES.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 deg F (10 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

A. Mastic and Intumescent Fire-Resistive Coating: Manufacturer's standard, factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.
1. Application: Designated for interior general purpose and "conditioned interior space purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
2. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
3. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25or less.
b. Smoke-Developed Index: 50 or less.

4. Hardness: Not less than [80, Type D durometer, according to ASTM D 2240.

5. Finish: As selected by Architect from manufacturer's standard finishes.

   a. Color and Gloss: As selected by Architect from manufacturer's full range < .

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

E. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.

   1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
   2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

E. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

F. Extend fireproofing in full thickness over entire area of each substrate to be protected.

G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

I. Cure fireproofing according to fireproofing manufacturer's written instructions.

J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

K. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

3.4 FIELD QUALITY CONTROL

A. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

B. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

C. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078123

SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide UL or equivalent approved firestopping system for the closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.

B. Provide UL or equivalent approved firestopping system for the closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 07 95 13, EXPANSION JOINT COVER ASSEMBLIES: Expansion and seismic joint firestopping.

C. Section 07 92 00, JOINT SEALANTS: Sealants and application.

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

E. Section 23 37 00, AIR OUTLETS AND INLETS: Fire and smoke damper assemblies in ductwork.

1.3 SUBMITTALS

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

B. Sustainable Design Submittals, as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Installer qualifications.

D. Inspector qualifications.

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

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

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

H. Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.

1.4 DELIVERY AND STORAGE

A. Deliver materials in their original unopened containers with manufacturer’s name and product identification.

B. Store in a location providing protection from damage and exposure to the elements.

1.5 QUALITY ASSURANCE

A. FM, UL, or WH or other approved laboratory tested products will be acceptable.

B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements." Submit qualification data.

C. Inspector Qualifications: Contractor to engage a qualified inspector to perform inspections and final reports. The inspector to meet the criteria contained in ASTM E699 for agencies involved in quality assurance and to have a minimum of two years' experience in construction field inspections of firestopping systems, products, and assemblies. The inspector to be completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector qualifications.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

E84-20.....Surface Burning Characteristics of Building Materials

E699-16.....Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components

E814-13a(2017) .....Fire Tests of Penetration Firestop Systems

E2174-20a.....Standard Practice for On-Site Inspection of Installed Firestop Systems

E2393-20.....Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

C. FM Global (FM):

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. Contain no flammable or toxic solvents.
   2. Release no dangerous or flammable out gassing during the drying or curing of products.
   3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
   4. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
   5. VOC Content: Firestopping sealants and sealant primers to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
      a. Sealants: 250 g/L.
      b. Sealant Primers for Nonporous Substrates: 250 g/L.
      c. Sealant Primers for Porous Substrates: 775 g/L.

D. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials to have following properties:
   1. Classified for use with the particular type of penetrating material used.
   2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.

E. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84 or UL 723. Material to be an approved firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.

F. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.

G. Materials to be nontoxic and noncarcinogen at all stages of application or during fire conditions and to not contain hazardous chemicals. Provide firestop material that is free from Ethylene Glycol, PCB, MEK, and asbestos.

H. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 101 mm (4 inches) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Submit product data and installation instructions, as required by article, submittals, after an on-site examination of areas to receive firestopping.

B. Examine substrates and conditions with installer present for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, grease, oil, laitance and form-release agents from concrete, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.

B. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on each side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

C. Prime substrates where required by joint firestopping system manufacturer using that manufacturer’s recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Masking Tape: Apply masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

3.3 INSTALLATION

A. Do not begin firestopping work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.

B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.

C. Install smoke stopping seals in smoke partitions.

3.4 CLEAN-UP

A. As work on each floor is completed, remove materials, litter, and debris.

B. Clean up spills of liquid type materials.

C. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

D. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to provide firestopping complying with specified requirements.

3.5 INSPECTIONS AND ACCEPTANCE OF WORK

A. Do not conceal or enclose firestop assemblies until inspection is complete and approved by the Contracting Officer Representative (COR).

B. Furnish service of approved inspector to inspect firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results. Submit written reports indicating locations of and types of penetrations and type of firestopping used at each location; type is to be recorded by UL listed printed numbers.

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Sealing of Site Work Concrete Paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

C. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.

D. Glazing: Section 08 80 00, GLAZING.

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

F. Mechanical Work: Section 22 05 11 COMMON WORK RESULTS FOR PLUMBING and Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.3 QUALITY ASSURANCE:

A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.

B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.

C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Lab Tests: Submit samples of materials that will be in contact or affect joint sealants to joint sealant manufacturers for tests as follows:

1. Adhesion Testing: Before installing elastomeric sealants, test their adhesion to protect joint substrates according to the method in ASTM C794 to determine if primer or other specific joint preparation techniques are required.
2. Compatibility Testing: Before installing elastomeric sealants, determine compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Perform testing per ASTM C1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work is to start until results of these tests have been submitted to the Contracting Officer Representative (COR) and the COR has given written approval to proceed with the work.

1.4 CERTIFICATION:

A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Sustainable Design Submittals, as described below:
   1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
C. Installer qualifications.
D. Contractor certification.
E. Manufacturer's installation instructions for each product used.
F. Cured samples of exposed sealants for each color.
G. Manufacturer's Literature and Data:
   1. Primers
   2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.
H. Manufacturer warranty.

1.6 PROJECT CONDITIONS:

A. Environmental Limitations:
   1. Do not proceed with installation of joint sealants under following conditions:
      a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).
      b. When joint substrates are wet.
B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 DELIVERY, HANDLING, AND STORAGE:

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.8 DEFINITIONS:

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Backing Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

1.9 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.10 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. ASTM International (ASTM):

C509-06 .....Elastomeric Cellular Preformed Gasket and Sealing Material
C612-14 .....Mineral Fiber Block and Board Thermal Insulation
C717-14a .....Standard Terminology of Building Seals and Sealants
C734-06(R2012) .....Test Method for Low-Temperature Flexibility of Latex Sealants after Artificial Weathering
C794-10 .....Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
C919-12. .....Use of Sealants in Acoustical Applications.
C920-14a .....Elastomeric Joint Sealants.
C1021-08(R2014) .....Laboratories Engaged in Testing of Building Sealants
C1193-13 .....Standard Guide for Use of Joint Sealants.
C1248-08(R2012) .....Test Method for Staining of Porous Substrate by Joint Sealants

C1330-02(R2013) .....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants

C1521-13 .....Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints

D217-10 .....Test Methods for Cone Penetration of Lubricating Grease

D1056-14 .....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber

E84-09.....Surface Burning Characteristics of Building Materials

C. Sealant, Waterproofing and Restoration Institute (SWRI).
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. Use NT.
2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T.
3. Provide location(s) of exterior sealant as follows:
   a. Joints formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Provide sealant at exterior surfaces of exterior wall penetrations.
   b. Metal to metal.
   c. Masonry to masonry or stone.
   d. Stone to stone.
   e. Cast stone to cast stone.
   f. Masonry expansion and control joints.
   g. Wood to masonry.
   h. Masonry joints where shelf angles occur.
   i. Voids where items penetrate exterior walls.
   j. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.

B. 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. 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.

2.2 COLOR:

A. Sealants used with exposed masonry are to match color of mortar joints.

B. Sealants used with unpainted concrete are to match color of adjacent concrete.

C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.3 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 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.

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.

3.7 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 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Prefabricated floor, wall, and ceiling building expansion joint assemblies.
   a. Elastomeric joint covers at floor, wall and ceiling joints.
   b. Exterior wall joints.

1.2 RELATED WORK

A. Section 05 50 00, METAL FABRICATIONS: Steel Plate Expansion Joint Covers.

B. Section 07 60 00, FLASHING AND SHEET METAL: Sheet Metal Expansion Joint Seals.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this Section.

B. American Society of Civil Engineers (ASCE):

ASCE/SEI 7-10 - Minimum Design Loads For Buildings and Other Structures.

C. ASTM International (ASTM):

A36/A36M-19 - Structural Steel.

A240/A240M-20 - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A283/A283M-18 - Low and Intermediate Tensile Strength Carbon Steel Plates.

A786/A786M-15 - Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.

B36/B36M-18 - Brass, Plate, Sheet, Strip, and Rolled Bar.

B121/B121M-16 - Leaded Brass Plate, Sheet, Strip 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, Profiles, and Tubes.

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

B455/B455M-20 - Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes.

C864-05(2019) - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

D1187/D1187M-97(2018) - Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

E1399/E1399M-97(2017) - Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.

E1966-15(2019) - Standard Test Method for Fire-Resistive Joint Systems.

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

AMP 500-06 - Metal Finishes Manual.

E. UL LLC (UL):

2079-15 - Standard for Tests for Fire Resistance of Building Joint Systems.

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.
   f. Manufacturer's field representative.
   g. Other installers responsible for adjacent and intersecting work.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Installation.
   f. Terminations.
   g. Transitions and connections to other work.
   h. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Include large-scale details indicating profiles of each type of expansion joint cover, splice joints between joint sections, transitions to other assemblies, terminations, anchorages, fasteners, and relationship to adjoining work and finishes.
2. Show size, configuration, and fabrication and installation details.
3. Include composite drawings showing work specified in other Sections coordinated with expansion joints.

C. Manufacturer's Literature and Data:

1. Description of each product specified.
2. Show movement capability of each cover assembly and suitability of material used in exterior seals for ultraviolet exposure.

3. Description of materials and finishes.
4. Installation instructions.

D. Samples: Submit 300 mm (12 inch) long samples.
1. Each type and color of metal finish for each required thickness and alloy.
2. Each type and color of flexible seal.

E. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
2. Low Pollutant-Emitting Materials:
a. Identify volatile organic compound types and quantities.

F. Qualifications: Substantiate qualifications comply with specifications.
1. Installer with project experience list.

G. Certificates: Indicate products comply with specifications.
1. Fire rated expansion joint cover assemblies.

H. Operation and Maintenance Data:
1. Care instructions for each exposed finish product.

1.6 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.

1.7 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, 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 facility.

B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify field conditions affecting expansion joint cover assembly fabrication and installation. Show field measurements on Submittal Drawings.
1. Coordinate field measurement and fabrication schedule to avoid delay.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Provide joint cover assemblies that permit unrestrained movement of joint without disengagement of cover, and, where applicable, maintain moisture, watertight and fire-rated protection.

B. Provide templates to related trades for location of support and anchorage items.

2.2 SYSTEM PERFORMANCE

A. Design expansion joint cover assemblies complying with specified performance.

B. Joint Movement: ASTM E1399.

1. Nominal Joint Width: 25 mm (1 inches).
2. Minimum Movement Capability: 50 percent.
3. Movement Type: Wind.

C. Floor Joints: Live loads, including rolling loads.

1. Load Resistance: ASCE/SEI 7; Design criteria as indicated on Drawings.
2. Maximum Deflection: 1/360 of span, maximum.

D. Fire Rated Joints: ASTM E1399, ASTM E1966, or UL 2079, including hose stream test at full-rated period.

1. Fire rating: Match adjacent floor, wall, and ceiling construction.
2. System: Capable of anticipated movement while maintaining fire rating.
3. Coverless Applications: Maintain fire rating without joint cover system.

2.3 MATERIALS

A. Stainless Steel: ASTM A240/A240M, Type 302 or 304.

B. Structural Steel Shapes: ASTM A36/A36M.

C. Steel Plate: ASTM A283/A283M, Grade C.

D. Rolled Steel Floor Plate: ASTM A786/A786M.

E. Aluminum:

1. Extruded: ASTM B221M (ASTM B221), alloy 6063-T5, 6063-T6, or 6061-T6.
2. Plate and Sheet: ASTM B209M (ASTM B209), alloy 6061-T6.

F. Elastomeric Sealant: As specified in Section 07 92 00, JOINT SEALANTS.

G. Elastomeric Seals:

1. Flexible extruded polyvinyl chloride, meeting a Shore A hardness of 75 with UV stabilizer. Manufacturer's standard colors.

H. Thermoplastic Rubber:

1. ASTM C864.
2. Dense Neoprene or other material standard with expansion joint manufacturers having the same physical properties.

I. Compression Seals: Pre-compressed secondary sealant using preformed expanding foam sealant; open-cell polyurethane foam impregnated with polymer-modified acrylic adhesive.

J. Water Barrier Sheets: Neoprene or EPDM flexible sheet materials minimum 45 mils thick.
   1. Provide with drain tubes for horizontal applications.
K. Vinyl Invertor Sealant Waterstops: Manufacturer's standard shapes and grade.
L. Moisture Barrier: Fabric reinforced clear vinyl sheet material sized to accommodate opening.
M. Flexible Membrane: 1.5 mm (60 mil) EPDM sheet, with manufacturer's standard support foam.
N. Fire Barrier: Labeled by an approved independent testing laboratory for fire resistance rating indicated for maximum joint width.
   a. Thermal Insulation: Manufacturer's standard with factory cut miters and transitions.
   b. Fire Barrier Lengths:
      1) Joint widths up to and including 150 mm (6 inches): Maximum 15 m (50 feet) to minimize field splicing.
      2) Other Joint widths: 3 m (10 foot) with overlapping ends for field splicing.
O. Ceramic Blanket: Manufacturer's standard joint filler to achieve fire rating indicated.
P. Butyl Caulk Tape: Self adhering double sided butyl rubber sealant tape with easy-release silicone coated paper.

2.4 PRODUCTS - GENERAL

A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
B. Provide each product from one manufacturer.
   1. Provide ceiling and wall expansion joint cover assemblies design matching floor to wall and floor to floor expansion joint cover design.
   2. Provide expansion joint cover assembly designs, profiles, materials and configuration indicated, as required to accommodate joint size variations in adjacent surfaces, and anticipated movement.
C. Sustainable Construction Requirements:
   1. Steel Recycled Content: 30 percent total recycled content, minimum.
   2. Stainless Steel Recycled Content: 70 percent total recycled content, minimum.
   3. Aluminum Recycled Content: 80 percent total recycled content, minimum.
   4. Low Pollutant-Emitting Materials: Maximum VOC content by weight.
      a. Non-Flooring Adhesives and Sealants.

2.5 FABRICATION

A. Fabricate Expansion Joint Cover Assemblies:
   1. As complete assembly ready for installation.
   2. In longest practicable lengths to minimize number of end joints.
   3. With factory mitered corners where joint changes directions or abuts other materials.
      a. With closure materials and transition pieces, tee-joints, corners, curbs, cross-connections and other assemblies.

4. Joints within enclosed spaces such as chase walls, include 1 mm (0.04 inch) thick galvanized steel cover where conventional expansion joint cover is not used.
5. Where floor slab is fire rated provide ceramic blanket at joints.
6. Seal Strip: Factory-formed and bonded to metal frames and anchor members.
7. Compression Seals: Fabricate from expanding foam as secondary seal and elastomeric sealant to sizes and profiles shown.

B. Floor-to-Floor Metal Plate Joints:
1. Basis of Design: Inpro 106 Series Surface Mount
2. Frames: Metal, continuous on both sides of joint designed to support cover plate.
   a. Flush Design: Seating surface and raised floor rim to accommodate adjacent flooring.
   b. Anchorage: Surface mount.
3. Cover Plate: Elastomeric
   a. Supported Load: 19.2 MPa (400 psf), minimum.
   b. Rattle-free due to traffic.
4. Fillers: Resilient material between raised rim of frame and edge of cover plate, where shown.
   a. No gaps or bulges over full design range joint movement.
5. Fire Barrier: As required for fire resistance rating.
6. Water Stop: Manufacturer's standard, continuous, full length of joint.
7. Finishes: To match adjacent.

C. Floor-to-Wall Metal Plate Joints:
1. Basis of Design: Inpro 106 Series Surface Mount.
2. Frames: Metal, continuous on floor side of joint only.
   a. Provide wall side frame where required by manufacturer's design.
3. Cover Plates: Angle elastomeric cover plates with countersunk flat-head exposed fasteners for securing cover plate to wall unless shown otherwise.
   a. Fastener Spacing: As recommended by manufacturer.
4. Joint Design: Match adjacent floor to floor design.
5. Fire Barrier: As required for fire resistance rating.
6. Water Stop: Manufacturer's standard, continuous, full length of joint.
7. Finishes: To match adjacent.

D. Interior Wall to Wall and Wall to Corner Joint Cover Assemblies:
1. Basis of Design: Inpro 118 Series Expansion Joint System
2. Frame: Metal, surface mounted, concealed fastening to wall on one sides of joint.
3. Cover Plate: Elastomeric
   a. Fabricate with concealed attachment of cover to frame when cover is in close contact with adjacent wall surface finish.
   b. Use angle cover plates at intersecting walls.

4. Joint Design: Match adjacent floor to floor design.
5. Fire Barrier: As required for fire resistance rating.
6. Finishes: To match adjacent.

E. Exterior Wall Joint Assemblies:
1. Design seal for variable movement and prevention of water and air infiltration.
2. Frame: Metal, concealed, for fastening to wall on one side of joint.
3. Cover Plate: Metal, surface mounted, lap both sides of joint, permitting free movement on one side.
   a. Fabricate with concealed attachment of cover to frame for cover with cover in close contact with adjacent finish surfaces.
   b. Use angle cover plate at intersecting walls.
4. Water Seal: Vinyl seal strip as secondary seal behind primary seal.
5. Finish: To match adjacent.

F. Extruded Thermoplastic Rubber Joint Assemblies:
1. Basis of Design Inrpo 616 Series
2. Frames: Aluminum, both sides of joint.
3. Primary Seal: Flexible rubber on exposed face after frame installation with factory welded watertight miters and transitions.
   a. Anchor spaced at ends and not over 600 mm (24 inches).
      1) Variable movement extruded rubber primary seal designed to remain in aluminum frame, throughout movement of joint.
   b. Recessed front face seal minimum 3 mm (0.12 inch) thick with no movement grooves, designed for plus or minus 50 percent movement of joint width.
   c. Provide pantographic wind load supports, maximum 2400 mm (8 feet) on center to support seal systems of 300 mm (12 inches) wide and greater.
4. Secondary Seal: Continuous vinyl sheet seal.
5. Finishes: To match adjacent metal panel finish

2.6 FINISHES

A. Carbon Steel: NAAMM AMP 500, Galvanized G90.
B. Stainless Steel: NAAMM AMP 500, No. 2B bright finish.
C. Aluminum Anodized Finish: NAAMM AMP 500.
1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.
2. Color Anodized Finish: AA-C22A42 or AA-C22A44; Class I Architectural, 0.018 mm (0.7 mil) thick.

D. Aluminum Paint Finish:
1. Fluorocarbon Finish: AAMA 605; 70 percent fluoropolymer resin, 2-coat system.

2.7 ACCESSORIES

A. General: Manufacturer's standard anchors, fasteners, set screws, spaces, protective coating, and filler materials, adhesive and other accessories required for installation.

B. Barrier Coating: ASTM D1187/D1187M.

C. Adhesives: Low pollutant-emitting, water-based type recommended by adhered product manufacturer for each application.

D. Fasteners: Type and size recommended by expansion joint cover assembly manufacturer.

1. Exterior Applications: Stainless steel.
2. Fasteners for Aluminum: Stainless steel.
3. Other Applications: Galvanized steel or stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

1. Provide items embedded in concrete and masonry in time for building into work without delaying work.

B. Protect existing construction and completed work from damage.

C. Apply barrier coating to surfaces in contact with dissimilar metals and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION

A. Install products according to manufacturer's instructions and approved submittal drawings .

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Install anchorage devices and fasteners for securing expansion joint assemblies to in-place construction where anchors are not embedded in concrete and masonry.

1. Secure with metal fasteners, type and size to suit application.

C. Perform cutting, drilling and fitting required for installation of expansion joint cover assemblies.

D. Install joint cover assemblies aligned and positioned in correct relationship to expansion joint opening and adjoining finished surfaces measured from established lines and levels.

1. Allow for thermal expansion and contraction of metal to avoid buckling.
2. Accommodate joint opening size at time of installation.

E. Set floor covers at elevations flush with adjacent finished flooring, unless shown otherwise.

F. Grout floor frames set in prepared recesses.

G. Locate wall, ceiling and soffit covers in continuous contact with adjacent surfaces. Secure with required accessories.

H. Locate anchors at interval recommended by manufacturer, but minimum 75 mm (3 inches) from each end, and, maximum 600 mm (24 inches) on centers.

I. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.

J. Cut and fit ends to accommodate thermal expansion and contraction of metal to avoid buckling of frames and cover plates.

K. Waterstops:

1. Install in conjunction with floor joints, and where shown.
2. Install continuously to prevent water damage to finish spaces.
3. Seal waterstop to frames to prevent water leakage.
4. Install drainage tubes from waterstops to discharge collected water in nearest plumbing air gap drain.

L. Fire Barriers:

1. Install in compliance with tested assembly.
2. Install at joints in floors and in fire rated walls.
3. Use fire barrier sealant furnished with expansion joint assembly.

M. Apply sealant where required to prevent water and air infiltration.

3.3 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed metal surfaces. Remove contaminants and stains.

3.4 PROTECTION

A. Cover floor joints with plywood where wheel traffic occurs before Substantial completion.

B. Remove protective covering when adjacent work areas are completed. Clean exposed surfaces in compliance with manufacture's printed instructions.

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SECTION 080671

DOOR HARDWARE SCHEDULE

PART 1 - PRODUCTS

1.1 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

1. GS - ASSA ABLOY Glass Solutions
2. MK - McKinney
3. PE - Pemko
4. SA - SARGENT
5. YA - ASSA ABLOY ACCENTRA
6. MC - Medeco
7. RO - Rockwood
8. NO - Norton

Hardware Sets

Set: 1.0

Doors: 112A
Description: EXT-EGRESS ALUM

6	Hinge, Hvy Wt	SP3386 4-1/2" x 4-1/2"	US10BE	MK
1	Surface Vert Rod Exit, Classroom	7170WS AU626F	613E	YA
1	Surface Vert Rod Exit, Exit Only	7170WS EO	613E	YA
1	Cylinder core - Medeco X-4	as required - match facility standard	13	MC
1	Housing	SFIC - As required	613E	YA
2	Surface Closer	UNI4400	613E	YA
1	Gasketing	by door / frame mfg		
1	Threshold	2005AT MSES25SS	10BE	PE

Notes:
Blast resistant aluminum door assembly. Design intent only. Modify to meet curtain wall blast standards.

Set: 2.0

Doors: 112B
Description: SGL – PULL-CLOSER

3	Hinge, Hvy Wt	SP3386 4-1/2" x 4-1/2"	US10BE	MK
1	Rim Exit Device, Classroom	7150 AU626F	613E	YA
1	Cylinder core - Medeco X-4	as required - match facility standard	13	MC
1	Housing	SFIC - As required	613E	YA
1	Surface Closer	UNI4400	613E	YA
1	Gasketing	by door / frame mfg		
1	Threshold	2005AT MSES25SS	10BE	PE

Notes:
Blast resistant aluminum door assembly. Design intent only. Modify to meet mfr blast standards.

Set: 3.0

Doors: 004, 006
Description: EXT - MEP

3	Hinge, Hvy Wt	SP3386 4-1/2" x 4-1/2"	US10BE	MK
1	Storeroom Lock (F07) HD	AUSL SL8840FL Temp Core	613E	YA
1	Cylinder core - Medeco X-4	as required - match facility standard	13	MC
1	Surface Closer	CPS7500	613E	NO
1	Kick Plate (J102)	K1050 10" CSK	US10BE	RO
1	Rain Guard (R0Y976)	346C	10BE	PE
1	Head Gasketing	2891AS		PE
1	Jamb Gasketing Set	290AS		PE
1	Sweep (R3B434)	315CN	10BE	PE
1	Threshold	2005AT MSES25SS	10BE	PE

Notes:
Blast resistant door assembly. Design intent only. Modify to meet mfr blast standards.

Set: 4.0

Doors: EX104, EX105, 202, 204, 303, 304
Description: TOILET

3	Hinge, Full Mortise (A8112)	H TA2714 4-1/2" x 4-1/2"	US4	MK
1	Privacy Lock (F22)	AUR 8802FL IND YMS	606	YA
1	Surface Closer	UNI4400	606	YA
1	Mop Plate (J103)	K1050 6" CSK	US4	RO

1	Door Stop (L02251 / L02121)*	403 / 446	US4	RO
1	Adhesive Gasketing (R0Y154)	S88BL		PE
1	Coat Hook (L03111)	RM804	US4	RO

Set: 5.0

Doors: 402, 403

Description: MECHANICAL

3	Hinge	5BB1HW 4.5 X 4.5	652	IVE
1	Storeroom lock	L9080HD 06A	626	SCH
1	Permanent core	1C7_2 (KEYED INTO OWNER'S EXISTING SYTEM)	626	BES
1	Oh stop	100S	630	GLY
1	Surface closer	4040XP REG ST-1630	689	LCN
1	Top jamb mtg plate	4040XP-18TJ	689	LCN
1	Kick plate	8400 8" X 2" LDW B-CS	630	IVE
3	Silencer	SR64	GRY	IVE

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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.

1.2 RELATED WORK

A. Section 05 50 00, METAL FABRICATIONS: Frames fabricated of structural steel.

B. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS: Aluminum frames entrance work.

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

D. Section 08 80 00, GLAZING: Glazing.

E. Section 08 39 53, BLAST RESISTANT DOOR AND FRAMES

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 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.

G. Blast Design Calculations.

1. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years of experience in design of blast resistant window systems, verifying door assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1, W2 and GP1, GP2 are defined in the Physical Security and Resiliency Design Standards Data Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need to know basis by the structural blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant doors to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA

Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Regularly manufactures specified products.
   2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.

1.6 DELIVERY

A. Fasten temporary steel spreaders across the bottom of each door frame before shipment.
B. Deliver products in manufacturer's original sealed packaging.
C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight 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. Blast Resistant Doors: Door, Frame and Anchorage:
      a. Standoff Distance: 25 feet (Life Safety Protected)
      b. Design Threat W1 at the standoff distance not to exceed pressure and impulse associated with GP1 threat for Life Safety Protected buildings
      c. Frame Rotation not to exceed L/20 (Life Safety Protected) while experiencing design level pressure and impulse.
      d. Glazing: Glazing shall meet the blast requirements shown in Specification 08 80 00.
      e. Minimum gauge of metal used on blast resistant doors shall be 14 gauge.

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.
D. Aluminum Sheet: ASTM B209M (ASTM B209).
E. Aluminum Extrusions: ASTM B221M (ASTM B221).

2.3 PRODUCTS - GENERAL

A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.

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

C. Sustainable Construction Requirements:

1. Steel Recycled Content: 30 percent total recycled content, minimum.
2. Aluminum Recycled Content: 80 percent total recycled content, minimum.

2.4 HOLLOW METAL DOORS

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

1. Exterior Doors: Level 4 and Physical Performance Level A, maximum heavy duty; Model 2, seamless at all locations.

B. Door Faces:

1. Interior Doors: Galvanized sheet steel minimum Z275 (G90) coating.
2. Exterior Doors: Galvanized sheet steel minimum Z275 (G90) coating.

C. Door Cores:

1. Interior Doors: Kraft paper honeycomb or vertical steel stiffeners.
2. Exterior Doors: Polystyrene or polyurethane.

2.5 HOLLOW METAL FRAMES

A. Hollow Metal Frames: ANSI A250.8; face welded. See drawings for sizes and designs.

1. Interior Frames:

a. Level 1 Hollow Metal Doors: 1.0 mm (0.042 inch) thick.

b. 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 1.3 mm (0.053 inch) thick.

e. Exterior Frames:

1) Level 4 Hollow Metal Doors: 1.7 mm (0.067 inch) thick.

B. Frame Materials:

1. Interior Frames: Galvanized sheet steel minimum Z275 (G90) coating.
2. Exterior Frames: Galvanized sheet steel minimum Z275 (G90) coating.

2.6 FABRICATION

A. Hardware Preparation: ANSI A250.8; for hardware specified in Section 08 71 00, DOOR HARDWARE.

B. Hollow Metal Door Fabrication:

1. Close top edge of exterior doors flush and seal to prevent water intrusion.
2. Fill spaces between vertical steel stiffeners with insulation.

C. Custom Metal Hollow Doors:

1. Provide custom hollow metal doors where nonstandard steel doors are shown on drawings.

a. Provide door sizes, design, materials, construction, gauges, and finish as specified for standard steel doors.

D. Hollow Metal Frame Fabrication:

1. Fasten mortar guards to back of hardware reinforcements, except on lead-lined frames.
2. Terminated Stops: ANSI A250.8.
3. 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) Modify frame anchors to fit special frame and wall construction.

7) Provide special anchors where shown on drawings and where required to suit application.

2.7 FINISHES

A. Galvanized Steel: ANSI A250.8; shop primed.

2.8 ACCESSORIES

A. Primers: ANSI A250.8.

B. Barrier Coating: ASTM D1187/D1187M.

C. Welding Materials: AWS D1.1/D1.1M, type to suit application.

D. Clips Connecting Members and Sleeves: Match door faces.

E. Fasteners: Galvanized steel.

1. Metal Framing: Steel drill screws.
2. Masonry and Concrete: Expansion bolts

F. Anchors: Galvanized steel.

G. Galvanizing Repair Paint: MPI No. 18.

H. Insulation: Unfaced mineral wool.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Apply barrier coating to metal surfaces in contact with cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 FRAME INSTALLATION

A. Apply barrier coating to concealed surfaces of frames built into masonry.

B. Plumb, align, and brace frames until permanent anchors are set.

1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
2. Use wood spreaders at bottom of frame when shipping spreader is removed.
3. Where construction permits concealment, leave shipping spreaders in place after installation, otherwise remove spreaders when frames are set and anchored.

4. Remove wood spreaders and braces when walls are built and jamb anchors are secured.

C. Floor Anchors:

1. Anchor frame jambs to floor with two expansion bolts.
   a. Lead Lined Frames: Use 9 mm (3/8 inch) diameter bolts.
   b. Other Frames: Use 6 mm (1/4 inch) diameter bolts.
2. Power actuated drive pins are acceptable to secure frame anchors to concrete floors.

D. Jamb Anchors:

1. Masonry Walls:
   a. Embed anchors in mortar.
   b. Fill space between frame and masonry with grout or mortar as walls are built.
2. Metal Framed Walls: Secure anchors to sides of studs with two fasteners through anchor tabs.
3. Prepared Masonry and Concrete Openings:
   a. Direct Securement: 6 mm (1/4 inch) diameter expansion bolts through spacers.
   b. Subframe or Rough Buck Securement:
      1) 6 mm (1/4 inch) diameter expansion bolts on 600 mm (24 inch) centers.
      2) Power activated drive pins on 600 mm (24 inches) centers.
   c. Secure two-piece frames to subframe or rough buck with machine screws on both faces.

E. 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 stile and rail wood doors transparent finish.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Paints and Coatings and Composite Wood and Agrifiber VOC Limits.
B. Section 08 71 00, DOOR HARDWARE: Door Hardware including hardware location (height).
C. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES: Installation of Doors.
D. Section 08 71 00, DOOR HARDWARE: Installation of Door Hardware.
E. Section 09 06 00, SCHEDULE FOR FINISHES: Door Finish.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.
B. American National Standards Institute/Window and Door Manufacturers Association (ANSI/WDMA):
   1. I.S. 6A-13 - Interior Architectural Stile and Rails Doors.
C. ASTM International (ASTM):
   1. E90-09(2016) - Laboratory Measurements of Airborne Sound Transmission Loss of Building Partitions and Elements.
D. National Fire Protection Association (NFPA):
   1. 80-16 - Fire Doors and Other Opening Protectives.
   2. 252-12 - Fire Tests of Door Assemblies.
E. UL LLC (UL):
   1. 10C-09 - Positive Pressure Fire Tests of Door Assemblies.
F. Window and Door Manufacturers Association (WDMA):
   1. TM 7-14 - Cycle-Slam Test.
   2. TM 8-14 - Hinge Loading Test.
   3. TM 10-14 - Screw Holding Capacity.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Submittal Drawings:
   1. Show size, configuration, and fabrication and installation details.
   2. Indicate project specific requirements not included in Manufacturer's Literature and Data submittal.

C. Manufacturer's Literature and Data:
   1. Description of each product.
D. Samples:
   1. Corner section of flush veneered door 300 mm (12 inches) square, showing details of construction, labeled to show grade and type number and conformance to specified standard.
   2. Veneer sample 200 mm by 275 mm (8 inch by 11 inch) showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample where the prefinished option is accepted.
E. Sustainable Construction Submittals:
   1. Low Pollutant-Emitting Materials: Show volatile organic compound types and quantities.
F. Test Reports: Indicate each product complies with specifications.
   1. Screw Holding Capacity Test.
   2. Cycle-Slam Test.
   3. Hinge-Loading Test.
G. Operation and Maintenance Data:
   1. Care instructions for each exposed finish product.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
   1. Minimum 0.15 mm (6 mil) polyethylene bags or cardboard packaging to remain unbroken during delivery and storage.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, and manufacture date.
   1. Identify door opening corresponding to Door Schedule.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging. Retain packaging for door protection after installation.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight, conditioned facility.
   1. Store doors according to ANSI/WDMA I.S. 1A.
B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Temperature Range: 21 to 27 degrees C (70 to 80 degrees F) continuously, beginning 48 hours before installation.
3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

   Comply with door manufacturer's instructions for relative humidity.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant interior factory finished stile and rail 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: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Provide each product from one manufacturer.

C. Sustainable Construction Requirements:

1. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
2. Paints and coatings.
3. Composite wood and agrifiber.

2.2 STILE AND RAIL WOOD DOORS

A. Doors: ANSI/WDMA I.S. 6A; Grade Premium size and design shown on drawings.

B. Species: to match existing doors.

C. Door Panels:

1. Grain of face of panels parallel with longest dimensions of panel.
2. Flat panels: Veneered composite core, minimum 16 mm (5/8 inch) thick.
3. Raised panels: Unless otherwise shown, thickness of raised panels minimum the following:
   a. For 35 mm (1-3/8 inch) and 44 mm (1-3/4 inch) thick doors: 28 mm (1-1/8 inch) thick.
4. Where armor plate is required for paneled doors, provide panels with plywood fillers, glued in place, and finished.

D. Stops and Molds:

1. Solid sticking both sides, same material as stiles and rails, coped joints.

2.3 FABRICATION

A. Factory machine interior wood doors to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.

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. 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.

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.

3.2 INSTALLATION

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 PROTECTION

A. After installation, place shipping container over door and tape in place.

1. Do not apply tape to door faces and edges.

B. Provide protective covering over exposed hardware in addition to covering door.

C. Maintain covering in good condition until removal is directed by Contracting Officer's Representative.

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SECTION 08 39 53

BLAST RESISTANT DOOR AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier to prepare the doors and frames to receive the finish hardware items per manufacturer's tested recommendations.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of moldings, removable stops, and glazing.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufactures that are not current members of the Steel Door Institute.

E. Informational Submittals:

1. Certificates of Compliance: Submit any information necessary to indicate compliance with this specification section.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver blast resistant hollow metal work palletized and crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store blast resistant hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.5 COORDINATION

A. Coordinate installation of anchorages for blast resistant hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages and items with integral anchors. Deliver such items to Project site in time for installation.

1.6 WARRANTY

A. Provide manufacturer's written one year warranty against defects in materials and workmanship upon final completion and acceptance of Work in this section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products equivalent to one of the following:

1. CECO Door Products (C).
2. Curries Company (CU).
3. Security Metal Products (SMP).

B. Substitutions: Material from alternate blast resistant door and frame fabricators will not be accepted on jobsite without prior written and sample approval in accordance with requirements specified in Division 01.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 BLAST RESISTANT HOLLOW METAL DOORS

A. General: Provide 1-3/4inch doors of type and design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel or vision lites per elevation.
2. Core Construction: Manufacturer's standard blast resistant door core construction designed or tested for the specified PSI rating.
   a. Fire Door Core: As required to provide fire-protection level specified.
3. Gauge, material and construction to match manufacturer’s tested design in core, face sheets and edge construction.

4. Surface Applied Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
5. Glazing: All glazing to be factory supplied and installed.

2.4 BLAST RESISTANT HOLLOW METAL FRAMES

A. General: Provide frames of the type and profile indicated, not less than thickness indicated; to comply with ANSI/SDI A250.8.
   1. Fabricate frames with mitered corners.
   2. Fabricate frames with "closed and tight" mitered, full depth continuously welded seams, finished smooth with no visible seam unless otherwise indicated. Knock down type frames are not permitted.
   3. Gauge, material and construction to match manufacturer’s tested design.

B. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

C. Surface Applied Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors: Locate anchors per manufacturer’s tested assembly.
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material not less than 0.042-inches thick, with corrugate or perforated straps not less than 2inches wide by 10-inches long; or wire anchors not less than 0.177-inches thick.
   2. Stud Wall Type: Designed to engage stud and not less than 0.042-inches thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042-inches thick.

C. Mortar Guards: Formed from the same material as frames, not less than 0.016-inches thick.

2.6 FABRICATION

A. Fabricate blast resistant hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate blast resistant hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Blast Resistant Hollow Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.

2. Continuous Hinge Reinforcement: Provide welded continuous 12 gage strap for continuous hinges specified in hardware sets in Division 08 Section, "Door Hardware".

D. Blast Resistant Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Full depth continuously weld frame seams; grind, fill, dress, and make smooth and flush.
   a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
2. High Frequency Hinge Reinforcement: Provide 12 gage angle reinforcements for butt type hinges on every door and frame assembly.
3. Continuous Hinge Reinforcement: Provide welded continuous 12 gage straps for continuous hinges specified in hardware sets in Division 08 Section, "Door Hardware".
4. Electrical Knock Out Boxes: Factory weld 18 gage electrical knock out boxes to frame for electrical hardware preps; this includes but not limited to electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as noted in door hardware sets in Division 08 Section, "Door Hardware".
   a. Provide electrical knock out boxes as required for Project.
5. Frame Mullions: Provide per manufacturer’s tested design.

E. Surface Hardware Preparation: Factory prepare blast resistant hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section, "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of blast resistant hollow metal work for hardware.
4. Coordinate locations of wiring boxes for electrical connections with Division 26 Sections.

2.7 STEEL FINISHES

A. Prime Finish: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded blast resistant hollow metal frames for squareness, alignment, twist, and plumbness.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install blast resistant hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Blast Resistant Hollow Metal Frames: Install blast resistant hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
   a. At fire-protection-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install door silencers in frames before grouting.
2. Anchors: Comply with drawings and manufacturer’s written instructions.

C. Blast Resistant Hollow Metal Doors: Fit blast resistant hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   c. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including blast resistant hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from blast resistant hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

3.5 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
   1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.
   2. Submit documentation of incomplete items in the following formats:
      a. PDF electronic file.
      b. Electronic formatted file integrated with the Openings Studio™ door opening management software platform.

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SECTION 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies blast resistant, glazed aluminum curtain wall system.
   1. Thermally isolated, pressure equalized on interior.
   2. Type: Stick or Unit and Mullion system to include following:
      a. Glass
      b. Integral reinforcing.
      c. Closures, trim, subsills and flashings.
      d. Column covers.
      e. Fasteners, anchors, and related reinforcement.

1.2 RELATED WORK:

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
B. Structural Steel: Section 05 12 00, STRUCTURAL STEEL FRAMING.
C. Miscellaneous Metal Members: Section 05 50 00, METAL FABRICATIONS.
D. Firestopping between Curtain Wall and Structure: Section 07 84 00, FIRESTOPPING.
E. Sheet Metal Flashing and Trim: Section 07 60 00, FLASHING AND SHEET METAL.
F. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
G. Exterior Doors: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES,
H. Aluminum and Glass Hinged Entry Doors and Storefront Construction: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
I. Glazing: Section 08 80 00, GLAZING.
J. Louvers and Wall Vents: Section 08 90 00, LOUVERS AND VENTS.

1.3 QUALITY ASSURANCE:

A. Qualifications:
   1. Approval by Contracting Officer Representative (COR) is required of products or service of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
      a. Manufacturers Qualifications: Manufacturer with five (5) years continuous documented experience in design, fabrication, and installation of glazed aluminum curtain wall systems of similar type and for projects of equivalent size.
      b. Installer: Manufacturer approved in writing who has continuously installed glazed aluminum curtain walls systems of similar type and for projects of equivalent size for previous five (5) years.

c. Manufacturer is to provide technical field representation at project site, as a minimum, at start of project, during middle, towards end of project, and during field testing of field mockup panel.

d. Manufacturers Professional Engineer Qualifications: A Professional Engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of glazed aluminum curtain walls that are similar to those indicated for this Project in material, design, and extent.

e. Testing Laboratory: Contractor is to retain AAMA accredited commercial testing laboratory to perform tests specified. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to perform testing specified in this section.

f. Product Options: Information on construction documents establishes requirements for aesthetic effects and performance characteristics of glazed aluminum curtain wall system. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one another, and adjoining construction. Performance characteristics are indicated by criteria subject to verification by one (1) or more methods including preconstruction testing, field testing, or in-service performance.

1) Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.

g. Qualification of Welders:

1) Welding is to be performed by certified welders qualified in accordance with AWS D1.2/D1.2M, using procedures, materials, and equipment of the type required for this work.

B. Pre-Installation Conference

1. Prior to starting installation of glazed curtain wall system schedule conference with COR to demonstrate the following:

a. Clear understanding of construction documents.

b. Onsite inspection and acceptance of structural and pertinent structural details relating to curtain wall system.

c. Coordination of work of various trades involved. Conference is to be attended by Contractor; personnel directly responsible for installation of curtain wall system, flashing and sheet metal work, firestopping system and curtain wall manufacturer and their technical field representatives. Conflicts are to be resolved and confirmed in writing.

d. Coordinate and review requirements and outlines of Manufacturer's Warranty.

1.4 SUBMITTALS:

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

B. Sustainable Design Submittals, as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Manufacturer's Literature and Product Data:

1. Manufacturer's standard details and fabrication methods.
2. Data on finishing, components, and accessories.
3. Instructions: Submit descriptive literature, detail specifications, performance test data and instructions for installation, and adjustments.
4. Recommendations for maintenance and cleaning of exterior surfaces.

D. Shop Drawings:

1. Show elevations of glazed curtain wall system at 1:48 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, flashing and coping details, glazing details, firestopping assemblies at edge of slabs and details of installation. Show interfaces and relationships to work of other trades and continuity with adjacent thermal, weather, air and vapor barriers.
2. Submit for curtain wall system and accessories.

E. Samples:

1. Submit pairs of samples of each specified color and finish on 305 mm (12-inch) long section by width of each tubular, or extruded shape section or 305 mm by 305 mm (12-inch by 12-inch) wide sections of sheet shapes.
2. Submit corner section of framing members showing fasteners, panels, glazing methods, glazing materials, and weather-stripping. Submit one (1) sample minimum 305 mm by 305 mm (12 inches by 12 inches). In lieu of submitting separate samples for corner section, intermediate section, and panel, one (1) composite sample incorporating all components and features listed may be submitted.
3. Where normal color variations are anticipated, include two (2) or more units of each sample indicating extreme limits of color variations.

F. Glass:

1. Specified in Section 08 80 00, GLAZING.

G. Quality Assurance Submittals:

1. Design Data:
   a. Submit structural and thermal calculations for complete wall assembly. Structural calculations and design shop drawings signed and sealed by a Professional Engineer (PE).

2. Factory Test Reports:
   a. Test Reports: Submit certified test reports, for each of following listed tests, from a qualified independent testing laboratory showing that glazed aluminum curtain wall system assembly has been tested in accordance with specified test procedures and complies with performance characteristics as indicated by manufacturer's testing procedures. Submit factory tests required except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested within last year, under conditions specified herein, resulting test reports may be submitted in lieu of listed testing. Submit appropriate testing reports for specific tests indicated below:
      1) Deflection and structural tests.
      2) Water penetration tests.
      3) Air infiltration tests.
      4) Delamination tests.
      5) Thermal conductance tests.

H. Manufacturer's Certificates:
   1. Submit Certificates of Compliance, with specification requirements, for the following:
      a. Metal extrusions.
      b. Metal accessories.
      c. Statement(s) that aluminum has been given specified thickness of anodizing or organic coating finish.
      d. Statement(s) indicating manufacturers and installers conform with qualifications as specified.
      e. Submit list (minimum of five (5)) of equivalent project size installations for both manufacturer and installer.

I. Manufacturer's Field Reports:
   1. Submit field reports of manufacturer's field representative observations of curtain wall installation indicating observations made during inspection at beginning of project, during middle of installation and at conclusion of project.

J. Welders: Submit welders qualifications as specified.

K. Testing Laboratory: Submit Testing Laboratory qualifications.

L. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.
   1. Show location and magnitude of loads applied to building structural frame.
   2. Identify deviations from details shown on drawings.
   3. Blast Design Calculations

a. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years of experience in design of blast resistant window systems, verifying storefront assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1,W2 and GP1,GP2 are defined in the Physical Security and Resiliency Design Standards Data Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need to know basis by the structural engineer blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant entrances and storefronts to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.

B. Prior to packaging for shipment from factory, mark wall components to correspond with shop and erection drawings and their placement location and erection sequence.

C. Prior to shipment from factory, place knocked-down lineal curtain wall members in cardboard containers and cover finished surfaces of members with protective covering of adhesive paper, waterproof tape, or strippable plastic. Do not cover metal surfaces that will be in contact with sealants after installation.

D. Inspect materials delivered to site for damage; unload and store with ventilation, free from heavy dust, not subject to combustion products or sources of water, and to permit easy access for inspection and handling. Sealing and caulking compounds, including handling, is to be in accordance with requirements of Section 07 92 00, JOINT SEALANTS.

1.6 PROJECT CONDITIONS:

A. Field Measurements: Where glazed aluminum curtain wall systems are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.

1.7 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.

B. American Architectural Manufacturers Association (AAMA):

501.8-14 ..... Test Method for Determination of Resistance of Human Impact of Window Systems Intended for Use in Psychiatric Applications

MCWM-1-89 ..... Metal Curtain Wall Manual

CW 10-12 ..... Care and Handling of Architectural Aluminum from Shop to Site

CW 11-85 ..... Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing

CW 13-85 ..... Structural Sealant Glazing Systems (A Design Guide)

TIR A11-04 ..... Maximum Allowable Deflection of Framing Systems for Building Cladding Components of Design Wind Loads

501-05 ..... Methods of Test for Exterior Walls

503-08 ..... Field Testing of Metal Storefronts, Curtain walls and Sloped Glazing Systems

2605-13 ..... High Performance Organic Coatings on Architectural Extrusions and Panels

C. American Society of Civil Engineers (ASCE):

ASCE 7-10..... Minimum Design Loads for Buildings and Other Structures

D. ASTM International (ASTM):

A36/A36M-12..... Structural Steel

A123/A123M-13..... Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A193/A193M-14a..... Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service

A307-14 ..... Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

B209-14 ..... Aluminum and Aluminum Alloy Sheet and Plate

B209M-14 ..... Aluminum and Aluminum Alloy Sheet and Plate (Metric)

B211-12 ..... Aluminum and Aluminum Alloy Bar, Rod, Wire

B211M-12 ..... Aluminum and Aluminum Alloy Bar, Rod, Wire (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)

B316/B316M-10..... Aluminum and Aluminum Alloy Rivet and Cold-Heading, Wire, and Rods

C578-14a ..... Rigid Cellular Polystyrene Thermal Insulation

C612-14 ..... Mineral Fiber Block and Board Thermal Insulation

C920-14a ..... Elastomeric Joint Sealants

C794-10 ..... Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.

C1193-13 ..... Guide for Use of Joint Sealants

C1363-11 ..... Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

C1521-13 ..... Practice for Evaluating Adhesion of Installed Weatherproofing

D1037-12 ..... Evaluating the Properties of Wood-Base Fibers and Particle Panel Materials

E84-14 ..... Surface Burning Characteristics of Building Materials

E330/E330M-14 ..... Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

E331-00(R2009) ..... Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference

E413-10 ..... Classification for Rating Sound Insulation

E783-02(R2010) ..... Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

E1105-00(R2008) ..... Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors By Uniform or Cyclic Static Air Pressure Differences

E. American Welding Society, Inc. (AWS):

D1.2/D.1.2M-06(R2014) ..... Structural Welding Code-Aluminum

F. Military Specifications (MIL):

MIL-C-18480 ..... (Rev. B) Coating Compound, Bituminous Solvent, Coal Tar Base

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

500 Series (2006) ..... Metal Finishes Manual

H. Society for Protective Coatings (SSPC)

Paint 25-97 (2004) ..... Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel Type 1 and Type II

Paint 20-82 (2019) ..... Zinc-Rich Coating, Type I-Inorganic, and Type II-Organic.

I. U.S. Veterans Administration:

Physical Security Design Manual for VA Facilities (VAPSDG); Life Safety Protected

Physical Security Design Manual for VA Facilities (VAPSDG); Mission Critical Facilities

Architectural Design Manual for VA Facilities (VASDM)

J. Environmental Protection Agency (EPA):

40 CFR 59(2014) ..... National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

1.8 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21, “Warranty of Construction”.

B. Manufacturer Warranty: Manufacturer shall warranty their glazed aluminum curtain wall system for a minimum of five (5) years from date of installation and final acceptance by the Government. Submit manufacturer warranty.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION:

A. Design Requirements:

1. Curtain Wall System: Tubular aluminum sections with thermal break condition framing, factory prefinished, vision glass, related flashings, anchorage and attachment devices.
2. System Assembly: Site or shop assembled.
3. Maximum wall framing member deflection, in a direction normal to plane of wall: 1/175 of its clear span or 20 mm (3/4 inch), whichever is less, when designed in accordance with requirements of AAMA TIR A11 and tested in accordance with ASTM E330/E330M.
4. Maximum wall framing member deflection when a plastered or gypsum wallboard surface is affected: 1/360 of span.
5. Maximum Framing Member Permanent Deformation: 0.2 percent of its clear span when tested in accordance with ASTM E330/E330M for a minimum test period of 10 seconds at 1.5 times design wind pressures indicated as part of structural drawing wind load requirements.

B. No glass breakage, or damage to fasteners, hardware or accessories is permitted due to deformation design requirements indicated.

a. Provide system complete with framing, mullions, trim, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing wall to structure as specified or indicated. Unless noted otherwise, comply with AAMA MCWM-1.

b. Obtain all components of curtain wall system, including framing from single manufacturer.

c. Fully coordinate system accessories directly incorporated and adjacent to contiguous related work and ensure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified. Coordinate continuity with adjacent thermal, weather, air and vapor barriers.

d. Provide system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects.

e. Provide wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified.

C. Calculations: Submit professionally prepared calculations to indicate how design requirements for structural loading, thermal, and other performance criteria have been satisfied.

2.2 PERFORMANCE REQUIREMENTS:

A. Delegated Design: Engage a qualified Professional Engineer, to design glazed aluminum curtain walls.

B. Conform with system performance requirements specified.

C. Provide curtain wall components tested in accordance with requirements below and meeting performance requirements specified:

1. System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall as indicated in Structural Drawings.
2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with Florida Building code. Provide with the following tolerances.
   a. Phase I: 3 stroke cycles using .005 x the story height – no damage or failure.
   b. Phase II: 3 stroke cycles using .010 x the story height – no damage or failure.
3. Water Penetration:
   a. No water penetration is to occur when wall is tested in accordance with ASTM E331 at a differential static test pressure of 20 percent of inward acting design wind pressure as indicated on structural drawings, but not less than 479 Pa (10 psf).
   b. Make provision in wall construction for adequate drainage to outside of water leakage or condensation that occurs within outer face of wall. Leave drainage and weep openings in members and wall open during test.
4. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783.
   a. Static-Air-Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
   b. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface maximum.
5. Deflections Test: ASTM E330/E330M, Procedure B:
   a. No member is to deflect in a direction parallel to plane of wall, when carrying its full design load, more than an amount which will reduce edge cover or glass bite below 75 percent of design dimension. No member after deflection under full design load, is to have a clearance between itself and top of panel, glass, sash, or other part immediately below it less than 3 mm (1/8 inch); clearance between member and an operable window or door is to be minimum 1.5 mm (1/16 inch).
      1) L/175 or L/240 + ¼” maximum.
6. Thermal Conductance Tests: ASTM C1363.

a. The thermal transmittance of opaque panels are not to exceed a U-value, Btu/hr./sq. ft./ degree F, as required and indicated on construction documents for exterior wall system, when tested in accordance with ASTM C1363. Average calculated thermal transmittance of complete wall assembly including panels, windows, and all other components are not to exceed a U-value of .42BTU/HR/FT^2/°F or less.

1) Condensation Resistance Factor (CRF_f): Minimum of 72.

7. Sound Attenuation Through Wall System (Exterior to Interior):

a. STC 35, measured in accordance with ASTM E413.

8. Physical Security Life Safety Protected Facilities:

a. Provide glazed aluminum curtain walls designed to meet or exceed the design and construction standards as provided in the Physical Security Design Manual for VA Facilities: Life Safety Protected.

1) Blast Resistance: Design level threat (W1) located at the standoff distance, but not greater than GP1.

2.3 MATERIALS:

A. Extruded Aluminum Framing Members: ASTM B221M (B221); 6063-T5 extruded aluminum for non-structural components or 6063-T6 extruded aluminum for structural members; temper and alloy as recommended by manufacturer.

B. Sheet Aluminum: ASTM B209M (B209); 6065-T5 temper and alloy as recommended by manufacturer.

1. Formed flashing and closures: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.
2. Extruded sill members: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.

C. Steel Sections: ASTM A36/A36M.

D. Fasteners:

1. For Exterior Cap Retainers: ASTM A193/A193M B8 300 series, stainless steel screws.
2. For Framework Connections: ASTM B211M (B211) 2024-T4 aluminum, ASTM A193/A193M B8 300 series, stainless steel, and ASTM B316 aluminum rivets, as required by connection.
3. For Anchoring Glazed Aluminum Curtain Wall to Support Structure: ASTM A307 zinc plated steel fasteners.

E. Shims: Metal or plastic.

F. Joint Sealants and Accessories:

1. In accordance with requirements specified in Section 07 92 00, JOINT SEALANTS.
2. Structural Flush Glazed Joints: High performance silicone sealant applied in accordance with manufacturer's recommendations.

3. Non-structural Flush Glazed Joints and Weather Seal Joints: Silicone sealants applied in accordance with manufacturer's recommendations.
4. Sealants used inside the weatherproofing system are to have a VOC content of 250g/L or less when calculated according to 40 CFR 59, (EPA Method 24).
5. Structural silicone sealant performance requirements: ASTM C920.
   a. Hardness: Type A, 30 durometer.
   b. Ultimate Tensile Strength: 1172 kPa (170 psi).
   c. Tensile at 150% Elongation (of original bench mark distance): 55 kPa (80 psi).
   d. Joint Movement Capability after 14 Day Cure: +/- 50%.
   e. Peel Strength Aluminum, After 21 Day Cure: 599 g/mm (34 pounds per inch).
6. Structural silicone is not be used to support dead weight of vertical glass or panels.
7. Comply with recommendations of sealant manufacturer for specific sealant selections.
8. Provide only sealants that have been tested per ASTM C794 to exhibit adequate adhesion to samples of glass and metal equivalent to those required for project.
9. Exposed Metal to Metal Joints: Silicone sealant selected from manufacturer’s standard colors.

G. Glazing Materials:
1. As specified under Section 08 80 00, GLAZING.
2. Glazing Gaskets:
   a. Exterior: Continuous EPDM gaskets at each glass and spandrel panel.
3. Glass Sizes and Clearances:
   a. Accommodate up to 32 mm (1.25 inch)glazing.
   b. Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip glass to remove flares or to reduce oversized dimensions. All cutting is to occur in factory.
4. Glass Setting Materials:
   a. Provide head bead and drive wedge required for glass installation to suit curtain wall system in accordance with manufacture’s recommendations.

H. Column Covers Exterior and Interior Surfaces: 3.18 mm (1/8 inch) thick prefinished aluminum, to match curtain wall mullion sections. Install to Manufacture’s written instructions. Fasten column covers to adjacent mullions. Do not fasten column covers to structural columns.

I. Firestopping: Refer to Section 07 84 00, FIRESTOPPING for requirements.

2.4 FABRICATION:

A. Curtain wall components are to be of materials and thickness indicated in construction documents. Details indicated are representative of required design and profiles. Maintain sightlines. Unless

specifically indicated or specified otherwise, methods of fabrication and assembly are to be at discretion of curtain wall manufacturer. Perform fitting and assembling of components in shop to maximum extent practicable. Anchorage devices are to permit adjustment in three directions. No exposed fasteners are permitted.

B. Joints:
   1. Joints exceeding +1.5 mm (+1/16") are to be mechanically fastened.
   2. Only at intersections of aluminum members with uniform hairline joints; rigidly secure and sealed in accordance with manufacturer's recommendations.

C. Ventilation and Drainage: Direct water leakage to exterior by means of concealed drainage system and weeps. Flashings and other materials used internally are to be nonstaining, noncorrosive, and nonbleeding.

D. Protection and Treatment of Metals:
   1. Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving shop.
   2. Provide protection against galvanic action wherever dissimilar metals are in contact, except in case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint conforming to MIL-C-18480 or apply appropriate caulking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.

E. Metal sills and Closures: Fabricate accessories, trim closures of sizes and shapes indicated from similar materials and finish as specified for wall system.

F. Concealed Interior Mullion Reinforcing: ASTM A36/A36M steel shapes as required for strength and mullion size limitations, hot dip galvanized after fabrication in accordance with ASTM A123/A123M.

G. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.

H. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.5 METAL FINISHES:

A. In accordance with NAAMM AMP500 series.

B. Anodized Aluminum:
   1. AA-C22A41 Chemically etched medium matte, with clear anodic coating, Class 1 Architectural, 0.7-mil thick (min.).
   2. Aluminum extrusions shall be produced from quality-controlled billets meeting AA-6063-T5.
   3. Exposed Surfaces shall be free of scratches and other serious blemishes.

4. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
5. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specification, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.

C. Testing:
1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh. Do not clean area further.
2. Submit samples with test area noted on each sample.

D. Concealed Steel Items: Galvanized in accordance with ASTM A123/A123M to 610 gm/sq. m (2.0 oz./sq. ft.). Primed with iron oxide paint.

E. Apply one (1) coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Prior to installation of glazed curtain wall system, arrange for representative(s) of manufacturer to examine structure and substrate to determine that they are properly prepared, and ready to receive glazed curtain wall work included herein.

B. Verifying Conditions and Adjacent Surfaces: After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in building frame.

3.2 PREPARATION:

A. Take field dimensions and examine condition of substrates, supports, and other conditions under which work of this section is to be performed to verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Contact between aluminum and dissimilar metals are to receive a protective coating of bituminous paint for prevention of electrolytic action and corrosion.

3.3 INSTALLATION:

A. Install and erect glazed curtain wall system and all components in accordance with written directions of curtain wall manufacturer. Match profiles, sizes, and spacing indicated on approved shop drawings.

B. Bench Marks and Reference Points: Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error

or discrepancy be discovered in location of marks, stop erection work in that area until discrepancies have been corrected.

C. Ensure that drainage system operates properly in accord with AAMA 501 procedures.

D. Do not proceed with structural silicone work when metal temperature is below 0 degrees C (32 degrees F).

E. Isolate between aluminum and dissimilar metals with protective coating or plastic strip to prevent electrolytic corrosion.

F. Install glazed aluminum curtain wall system so as to maintain a virtually flat face cap, with no visible bowing.

G. Install entire system so that fasteners are not visible.

H. Tolerances:

1. Maximum variation from plane or location shown on approved shop drawings: 3 mm per 3657 mm (1/8 inch per 12 feet) of length up to not more than 13 mm (1/2 inch) in any total length.
2. Maximum offset from true alignment between two (2) identical members abutting end to end in line: 0.8 mm (1/32 inch).
3. Sealant Space Between Curtain Wall Mullion and Adjacent Construction: Maximum of 19 mm (3/4 inch) and minimum of 6 mm (1/4 inch).

I. Joint Sealants:

1. Joint Sealants: Are to be in accordance with requirements of Section 07 92 00, JOINT SEALANTS.
2. Surfaces to be primed and sealed are to be clean, dry to touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to proper depth. Joint dimensions are to conform to approved detail drawings with a tolerance of plus 3 mm (1/8 inch). Do not apply compound unless ambient temperature is between 5 and 35 degrees C (40 and 90 degrees F). Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings are to be of type that leave no residue on metals.
3. Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound is to be uniformly smooth and free of wrinkles and, unless indicated otherwise, is to be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four (4) hours, but at no time is this amount exceed 19 liters (5 gallons).

4. Apply primer to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after sealant work is completed.
5. Tightly pack backing in bottom of joints which are over 13 mm (1/2 inch) in depth with specified backing material to depth indicated in construction documents. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.
6. Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.
7. Remove compound smears from surfaces of materials adjacent to sealed joints as work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with solvent approved by sealant and curtain wall manufacturers. Upon completion of sealing, remove remaining smears, stains, and other soiling, and leave work in clean neat condition.

J. Glass:

1. Refer to Section 08 80 00, GLAZING, and drawings for glass types. Install in accordance with manufacturer's recommendations as modified herein.
2. Before installing glass, inspect sash and frames to receive glass for defects such as dimensional variations, glass clearances, open joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.
3. Clean sealing surfaces at perimeter of glass and sealing surfaces of rebates and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets.
4. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer and by curtain wall manufacturer.
5. Provide sashes designed for outside glazing.
6. Provide continuous snap in glazing beads to suit glass as specified.
7. Insulating and tempered glass, and glass of other types that exceed 2540 mm (100 united inches) in size: Provide void space at head and jamb to allow glass to expand or move without exuding sealant. Provide perimeter frames and ventilator sections with glazing rebates for unobstructed glazing surface 19 mm (3/4 inch) in height. Glazing rebate surfaces must be sloped to shed water.
8. Provide adequate means to weep incidental water and condensation away from sealed edges of insulated glass units and out of wall system. Provide weeping of lock-strip gaskets in accordance with recommendation of glass manufacturer.

K. Metal Copings:

1. Refer to Section 07 60 00, FLASHING AND SHEET METAL for requirements of metal copings when they are not a part of glazed curtain wall system work.
2. Coordinate curtain wall installation with metal coping detail on construction documents. Provide watertight seal to meet criteria set forth in this section regarding air and water penetration.

3.4 ADJUSTING:

A. Adjust doors to provide a tight fit at contact points and operate easily.
B. Adjust weather-stripping to make even contact with surfaces.
C. Adjust operating hardware and moving parts.

3.5 CLEANING:

A. Install curtain wall frame and associated metal to avoid soiling or smudging finish.
B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
C. Remove excess glazing and sealant compounds, dirt, and other substances.
D. Follow recommendations of manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
E. Replace cracked, broken, and defective glass with new glass at no additional cost to Government. Just prior to final acceptance of curtain wall system clean glass surfaces on both sides, remove labels, paint spots, compounds, and other defacements, and clean metal fixed panels. Remove and replace components that cannot be cleaned successfully.

3.6 FIELD QUALITY CONTROL:

A. Testing Agency: Engage an AAMA accredited commercial qualified independent testing and inspecting agency to perform field quality-control tests specified, and to prepare test reports: Submit information regarding testing laboratory's facilities and qualifications of technical personnel to COR for approval.
B. Conduct field check test for water leakage on designated wall areas after erection to comply with AAMA MCWM-1. Conduct test on two (2) wall areas, two (2) bays wide by two (2) stories high where directed. Conduct test and take necessary remedial action as directed by COR.
C. Test Specimen:
   1. Test specimen is to include curtain wall assembly and construction. Test chamber is to be affixed to exterior side of test specimen and test is to be conducted using positive static air pressure.
   2. Test specimens are to be selected by COR after curtain wall system has been installed in accordance with construction documents.
D. Sealant Adhesion Tests: Test installed sealant, in presence of sealant manufacturer’s field representative, in a minimum of two (2) areas and as follows:

1. Test structural silicone sealant according to field adhesion test method described in AAMA CW 13.
2. Test weatherseal 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.

E. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783 and to values indicated below, whichever is more stringent.
1. Field air leakage testing is not required for continuous curtain wall systems.
2. Static-Air-Pressure Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
3. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface maximum.

F. Water Penetration: Test glazed aluminum curtain wall system for compliance with requirements according to AAMA 503, which requires testing according to ASTM E1105.
1. Uniform Static-Air-Pressure Difference: 20 percent of positive design wind load, but not less than 479 Pa (10 psf). No uncontrolled water is to be present.

G. Retesting:
1. Should system fail field test, system may be modified or repaired, and retested.
2. Should system fail second field test, system may be additionally modified or repaired, and retested.
3. All modifications and repairs made to tested areas are to be recorded, and same modifications and repairs made to all system and adjacent construction on project.
4. Should second test fail, COR may require testing of additional areas of the curtain wall.

H. Rejection:
1. Failure of any of specimens to meet test requirements of third test is cause for rejection of wall system and adjacent construction on project.

3.7 DEMONSTRATION, TESTING, AND ACCEPTANCE:

A. Instruct Government's personnel in proper operation and maintenance of entrance door equipment. Train personnel in procedures to follow in event of operational failures or malfunctions.

B. Acceptance: At completion of project, and as a condition of acceptance, entrance door and systems are to be operated for a period of fifteen (15) consecutive calendar days without breakdown.

3.8 PROTECTION:

A. After installation, protect windows, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods are to be in accordance with recommendations of product manufacturers or of respective trade association. Remove

paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or respective trade association.

- - - END - - -

SECTION 084523

BLAST RATED INSULATED TRANSLUCENT FIBERGLASS SANDWICH PANEL SKYLIGHT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the insulated, translucent sandwich panel system and accessories as shown and specified. Work includes providing and installing:

1. **Flat** insulated, translucent sandwich panels
2. Aluminum clamptite installation system
3. Aluminum flashing attached to Skyroofs

B. Related Sections:

1.2 SUBMITTALS

A. Submit manufacturer's product data. Include construction details, material descriptions, profiles, and finishes of components.

B. Submit shop drawings. Include plans, elevations, and details.

C. Submit manufacturer's color charts showing the full range of colors available for factory finished exposed aluminum.

1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below.
   a. Sandwich panels: 7" x 12" units
   b. Factory finished aluminum: 3" long sections

D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

E. Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Reports required (if applicable) are:
   a. Flame Spread and Smoke Developed (UL 723) – Submit UL Card
   b. Burn Extent (ASTM D 635)
   c. Color Difference (ASTM D 2244)
   d. Impact Strength (UL 972)
   e. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037)
   f. Bond Shear Strength (ASTM D 1002)
   g. Beam Bending Strength (ASTM E 72)
   h. Insulation U-Factor (NFRC 100)
   i. NFRC System U-Factor Certification (NFRC 700)
   j. NFRC Visible Light Transmittance (NFRC 202)
   k. Solar Heat Gain Coefficient (NFRC or Calculations)

l. Condensation Resistance Factor (AAMA 1503) (Thermally Broken, insulated panels only)
m. Air Leakage (ASTM E 283)
n. Structural Performance (ASTM E 330)
o. Water Penetration (ASTM E 331)
p. Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure (ASTM E2707)
q. Fall Through Resistance (ASTM E 661)
r. Class A Roof Covering Burning Brand (UL 790)
s. UL Listed Class A Roof System (UL 790) (Optional) – Submit UL Card

1.3 CLOSEOUT SUBMITTALS

A. Provide field maintenance manual to include in project maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope, and location. At least three of the projects shall have been in successful use for ten years or longer.
2. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural, and water infiltration testing of sandwich panel systems by an accredited agency.
3. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components, and production sandwich panels for conformance with AC177 "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems" as issued by the ICC-ES.

B. Installer's Qualifications: Installation shall be by an experienced installer, which has been in the business of installing Kalwall panel systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope, and type.

1.5 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.
B. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.

1. Show location and magnitude of loads applied to building structural frame.
2. Identify deviations from details shown on drawings.
3. Blast Design Calculations
   a. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years of experience in design of blast resistant window systems, verifying storefront assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1,W2 and GP1,GP2 are defined

in the Physical Security and Resiliency Design Standards Data Definitions which is a document separate from the referenced VA Security and Resiliency Design Manual. The Physical Security and Resiliency Design Standards Data Definitions are provided on a need to know basis by the structural engineer blast specialist performing the blast design on VA projects. It is the responsibility of the delegated engineer responsible for the design of blast resistant entrances and storefronts to request and obtain the Physical Security and Resiliency Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

C. Insert structural loads, as determined by project's structural engineer in subparagraphs below. Insert all loads in PSF, not wind speed. Indicate whether the provided wind load is Ultimate or ASD.

D. Structural Loads. Provide Skyroof system capable of handling the following loads:

a. Live Load (PSF): 20 PSF
b. Snow Load (PSF): 14 PSF
c. Drift Load (PSF): 0 PSF (no drift)
d. Wind Load (PSF): 16 PSF / -32 PSF uplift (ultimate)

E. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 110 deg F (43 deg C), ambient; 150 deg F (66 deg C), material surfaces.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver panel system, components, and materials in manufacturer's standard protective packaging.

B. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer's storage and handling instructions.

1.7 WARRANTY

A. Provide manufacturer's and installer's written warranties agreeing to repair or replace panel system work, which fails in material or workmanship, within one year from the commencement date. The commencement date of the warranty shall be the date of substantial completion, but no more than six months from date of delivery. Failure of material or workmanship shall include deterioration of finish on metal in excess of normal weathering; and defects in accessories; insulated, translucent sandwich panels; and other components of the work.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The basis for this specification is for products manufactured by Kalwall Corporation. Other manufacturers may bid this project subject to compliance with the performance requirements of this specification and submission of evidence thereof. Listing other manufacturers' names in this specification does not constitute approval of their products or relieve them of compliance with all the performance requirements contained herein.

B. Kalwall Corporation, Shaffner Heaney, John Owens 502 693 4590 jowens@shaproducts.com

2.2 PANEL COMPONENTS

A. Face Sheets:

1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
   a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
   b. Face sheets shall not deform, deflect, or drip when subjected to fire or flame.
2. Interior face sheets:
   a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than **50** and smoke developed no greater than 450 when tested in accordance with UL 723.
   b. Burn extent by ASTM D 635 shall be no greater than 1".
3. Exterior face sheets:
   a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after **3** years outdoor South Florida weathering at 5° facing south as measured on a white sample, with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
   b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of **70** without fracture or tear when impacted by a 3-1/4" diameter, 5 lb. free-falling ball per UL 972.
   c. Erosion Protection: Integral, embedded-glass erosion barrier.
4. Appearance:
   a. Exterior face sheet: Smooth, .070 thick and crystal in color.
   b. Interior face sheet: Smooth, .045 thick and White in color.
   c. Face sheets shall not vary more than ± 10% in thickness and be uniform in color.

B. Grid Core:

1. Thermally Broken I-beam grid core shall be of alloy and temper recommended by manufacturer with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16".
2. I-beam Thermal break: Minimum 1", thermoset fiberglass composite. Poured and de-bridged thermal break is not acceptable.

C. Laminate Adhesive:

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council “Acceptance Criteria for Sandwich Panel Adhesives".
2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:
   a. 50% Relative Humidity at 68° F: 540 PSI
   b. 182° F: 100 PSI
   c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
   d. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

2.3 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

1. Thickness: 2-3/4 inches
2. Grid Core Insulation: Fill panel cores with **fiberglass batt**
3. Panel U-factor by NFRC certified laboratory:
   a. 2-3/4” thermally broken grid .23U
4. Complete insulated panel system shall have NFRC certified U-factor of .23U
5. Visible Light Transmittance (VLT): **26%**
6. Solar heat gain coefficient: .30
7. Grid pattern as viewed: Nominal size 12x24 Shoji

B. Standard panels shall deflect no more than 1.9” at 30 PSF in 10’-0” span without a supporting frame by ASTM E 72.

C. Panels shall meet the conditions of acceptance according to ASTM E2707 Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure:
1. Absence of flame penetration through the wall assembly at any time.
2. Absence of evidence of glowing combustion on the interior surface of the assembly at the end of the 60-min observation period.
3. Absence of evidence of flame, glow, and smoke if the test is terminated prior to the completion of the 60-min observation period.

D. Thermally broken, insulated panels: Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.

E. Skyroof System:

1. Skyroof system shall pass Class A Roof Burning Brand Test by UL 790.

F. Skyroof System shall meet the fall through requirements of OSHA 1910.21 as demonstrated by testing in accordance with ASTM E 661, thereby not requiring supplemental screens or railings.

2.4 ALUMINUM CLAMPTITE INSTALLATION SYSTEM

A. Aluminum clamptite installation system:

1. Clamp-tite screw type closure system shall be of extruded aluminum alloy and temper as recommended by manufacturer.
2. Curved alumiumum clamptite installation system may be roll formed.
3. Skyroof perimeter aluminum clampite installation system at curbs shall be factory sealed to panels.

B. Sealing tape: Manufacturer's standard, pre-applied to aluminum clamptite installation system at the factory under controlled conditions.

C. Fasteners: 300 series stainless steel screws for aluminum clamptite installation system, excluding final fasteners to the building.

D. Finish:

1. Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer shall examine substrates, supporting structure, and installation conditions.

B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by sealant manufacturer for this purpose.
2. Where aluminum will contact concrete, masonry, or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by sealant manufacturer.

3.3 INSTALLATION

A. Install the panel system in accordance with the manufacturer's fabrication drawings and suggested installation instructions.

1. Anchor component parts securely in place by permanent mechanical attachment system.
2. Accommodate thermal and mechanical movements.
3. Seal aluminum clamptite installation system as shown on the manufacturer’s fabrication drawings and suggested installation instructions.

B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturers fabrication drawings and suggested installation instructions.

3.4 FIELD QUALITY CONTROL

A. Water Test: Installer to test a representative section of installed materials according to procedures in AAMA 501.2.

B. Repair or replace work that does not pass testing or that is damaged by testing and retest work.

3.5 CLEANING

A. Clean the panel system, interior and exterior, immediately after installation.

B. Refer to manufacturer's written recommendations.

END OF SECTION 084523

SECTION 08 52 00

ALUMINUM CLAD WOOD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-clad wood windows.

1.2 RELATED WORK

A. Section 08 80 00, Glazing

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at the project site

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of wood windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for wood windows.

B. Shop Drawings:

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

D. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of hardware and accessories involving color selection.

E. Samples for Verification: For wood windows and components required, prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches in size.
2. Exposed Hardware: Full-size units.

F. Product Schedule: For wood windows. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each type of wood window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Products must be certified by independent third parties and labeled as having been produced in compliance with the accepted principles of sustainable forest management. Current sustainability certification systems that comply include the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), and Program for the Endorsement of Forest Certification (PEFC).

B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.

C. Vendor Qualifications: A vendor that is certified for chain of custody by a SFI-, FSC-, or PEFC-accredited certification body.

D. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical wall area as indicated on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure to meet performance requirements.
   b. Structural failures including excessive deflection, water leakage, and air infiltration.
   c. Faulty operation of movable sash and hardware.
   d. Deterioration of materials and finishes beyond normal weathering.
   e. Failure of insulating glass.
2. Warranty Period:
   a. Window: 10 years from date of Substantial Completion.
   b. Glazing Units, Non-laminated: 10 years from date of Substantial Completion.
   c. Glazing Units, Laminated: 10 years from date of Substantial Completion.

d. Aluminum-Cladding Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain wood windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: WDMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: CW
2. Minimum Performance Grade: 30

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K)

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.

E. Sound Transmission Class (STC): Rated for not less than 26 STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.

F. Outside-Inside Transmission Class (OITC): Rated for not less than 26 OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.

G. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone basic protection.

2.3 WOOD WINDOWS

A. Aluminum-Clad Wood Windows Basis of Design: Pella Reserve Precision Fit. Any deviation from this will need to be approved by the COR.

B. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Double hung.

C. Certified Wood: Wood products to be labeled in accordance with the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004, or be certified and labeled in accordance with the standards of the Programme for Endorsement of Forest Certification.

D. Certified Wood: Wood products to contain not less than 60 percent certified wood tracked through a chain-of-custody process. Certified wood documentation to be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."

E. Certified Wood: Wood products to be certified in accordance with the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.

F. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints on linear members, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.

1. Exterior Finish: Aluminum-clad
   a. Aluminum Finish: Manufacturer's standard baked-on enamel finish.
2. Interior Finish: Manufacturer's standard stain-and-varnish finish.
   a. Exposed Unfinished Wood Surfaces: Manufacturer's standard species.
   b. Stain Color: as selected by Architect.

G. Windborne-Debris-Impact-Resistant Insulating-Glass Units: ASTM E2190 with two lites and complying with impact-resistance requirements in "Window Performance Requirements" Article.

1. Exterior Lite: ASTM C1036, Type 1, Class 1, q3.
   a. Tint: Clear.
   b. Kind: Fully tempered.
2. Interior Lite: ASTM C1172 clear laminated glass with two plies of float glass.
   a. Float Glass: Fully tempered.
   b. Interlayer Thickness: As required by performance requirement indicated.
3. Filling: Fill space between glass lites with air.
4. Low-E Coating: Pyrolytic on second surface.

H. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: Brown.

I. Hung Window Hardware:

1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

J. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

K. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
   1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 FABRICATION

A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.
B. Glaze wood windows in the factory.
C. Weather strip each operable sash to provide weathertight installation.
D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
E. Window Assemblies: Provide operating units in configuration indicated. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
   1. Angled interior and exterior extension and trim.
   2. Clear maple head and seat boards.
   3. Exterior head and sill casings and trim.
   4. Support brackets.
F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action (dissimilar materials, treated lumber, etc.) at the points of contact with other materials.

D. For fin method of attachment, integrate window system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with window manufacturer's written instructions.

E. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using backer rod and sealant.

F. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

G. Leave windows closed and locked.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows to take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance to be performed in accordance with AAMA 502.

2. Air-Infiltration Testing:

a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.

b. Allowable Air-Leakage Rate: 1.5 tmes the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

a. Test Pressure: Two-third times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.

b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows to be tested after perimeter sealants have cured.

5. Test Reports: Prepared in accordance with AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

- - END - -

SECTION 08 63 00

METAL FRAMED SKYLIGHTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Metal Framed Structural Skylights.

B. Related Sections may include, but are not limited to the following:
   1. Division 5 Section “Structural Steel” for steel framing.
   2. Division 8 Section “Glass and Glazing”
   3. Division 7 Section “Joint Sealants” for sealants installed at metal-framed skylight perimeters.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide metal-framed skylights capable of withstanding loads and thermal and structural movements indicated without failure. Failure includes the following:
   1. Deflection exceeding specified limits.
   2. Thermal stresses transferred to the building structure.
   3. Skylight framing members transferring stresses, including those caused by thermal and structural movement, to glazing.
   4. Weakening of fasteners, attachments, and other components.

B. Deflection Limits: As follows:
   1. Deflection Normal to Glazing Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.

C. Structural Loads: Provide metal-framed skylights, including anchorage, capable of withstanding the effects the following design loads when supporting full dead loads:
   1. Roof Loads
      a. Concentrated Load: 250lbs applied to framing members at location that produces the most severe stress or deflection.
      b. Snow Loads: 20 psf, minimum
      c. Roof Loads: 39 psf, minimum
      d. Wind Loads: 20 psf, minimum per ASCE 7
   2. Seismic Loads: as required per Risk Category II, Site Class D

D. Structural Performance: Provide metal-framed skylights, including anchorage, capable of withstanding pressures indicated without material and deflection failures and permanent deformation of structural members exceeding 0.2 percent of span when tested according to ASTM E 330.

E. Air Infiltration: Provide metal-framed skylights with maximum air leakage of 0.23 scfm/sq. ft. (1.15 L/s per sq. m) of surface when tested according to ASTM E 283 at a minimum static-air-pressure differential of 6.20lbs/sq. ft. (300 Pa).

F. Water Penetration: Provide metal-framed skylights that do not evidence water penetration when tested according to ASTM E 331 at a minimum differential static pressure of 12 lbs/sq. ft. (718 Pa).

G. Thermal Movement: Provide metal-framed skylights that allow for thermal movements resulting from the following maximum change (range) in ambient temperatures by preventing buckling, sealant failure, and other detrimental effects.

1. Temperature Change (Range): 100 degrees F.

H. Thermal Performance: Provide metal-framed skylights that meet current State Energy Code requirements (2015 IECC), including:

1. NFRC 200 rated SHGC of .25 or less.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions and profiles of components, and finishes for metal-framed skylights.

B. Shop Drawings: For metal-framed skylights. Include plans, elevations, sections, details, and attachments to other work as required.

C. Samples for Initial Selection: Manufacturer’s color charts consisting of sections of units showing the full range of colors available for factory-finished aluminum.

D. Samples for Initial Selection: Provide manufactuer’s full range of visible light transmittance for glazing, to be selected by Architect/Engineer and COR.

E. Samples for Verification: Provide color sample of selected finish on 2"x3" aluminum sheet.

F. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.

G. Product Test Reports: From a qualified testing agency indicating skylights comply with requirements, based on comprehensive testing of current products.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer with 10 years experience who has specialized in installing metal-framed skylights similar to those indicated for this Project and who is acceptable to manufacturer.

B. Professional Engineer Qualifications: A professional engineer who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of skylights that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where metal-framed skylights are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating skylights without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 WARRANTY

A. Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of metal-framed skylights that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures.
   2. Failure of systems to meet performance requirements.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   4. Water leakage; defined as uncontrolled water appearing on normally exposed interior surfaces of skylights from sources other than condensation, resulting from defects in skylight materials or workmanship. (Water controlled by flashing and gutters and drained back to the exterior and that cannot damage adjacent materials or finishes is not water leakage). Water leakage resulting from improper installations not part of this warranty.

B. System Warranty Period: 5 years from date of shipment from the manufacturer.

C. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

D. Finish Warranty: Provide written warranty signed by manufacturer agreeing to repair or replace work with finish defects. “Defects” is defined as peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required.
   1. Warranty Period for 2605 Powder Finish: 20 years from the date of shipment from the manufacturer.

PART 2 - PRODUCTS

2.1 FRAMING MATERIALS

A. Framing Members: Extruded aluminum alloy 6063-T5 or T6, ASTM B 221 with minimum effective thickness of 0.109 inches.

B. Exterior Pressure Caps: Extruded aluminum alloy 6063-T5 or T6, ASTM B 221 with minimum effective thickness of 0.090 inches.

C. Concealed Flashing: Manufacturer’s standard corrosion-resistant, non-staining, non-bleeding flashing; compatible with adjacent materials.

D. Exposed Flashing and Closures: Aluminum sheet alloy and temper of 1100-H14, thickness as require for proper performance.
   1. Minimum Thickness: 0.032 inch Apron Flashing.
   2. Minimum Thickness: 0.062 inch Closures.

E. Fasteners and Accessories: Manufacturer’s standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories; compatible with adjacent materials.

1. Aluminum Retaining Cap Fasteners and Framing Members Fasteners: ASTM A 193/A 193M, Series 300 stainless-steel screws; type as recommended by manufacturer.
2. Connections to Supporting Structure: Series 300 Stainless Steel or ASTM A 307, hot dipped galvanized steel fasteners by installer.

F. Framing-System Sealants: Single-component, non-sag, high performance, non-priming, gun-grade elastomeric polyurethane sealant furnished by skylight manufacturer.
1. Sealant complies with ASTM C920, Type S, Grade NS, Class 25, Use T, NT, M, A, G, and O. Canadian Specification CAN/CGSB-19.13-M87, Classification MCG-2-25-A-N.
2. Sealant conforms to USDA approval standards.

G. Bituminous Paint: Cold-applied asphalt mastic paint complying with SSPC-Paint 12, except containing no asbestos, and formulated for 30-mil thickness per coat.

2.2 GLAZING MATERIALS

A. Sloped Glass: Refer to specification Section 08 80 00 Glazing.
1. Glass must meet the requirements of the AAMA Glass Design for Sloped Glazing for the project.

B. Glazing Sun Control Film: Manufacturer's standard coating or film for interior application.

C. Glazing Gaskets: Manufacturer's proprietary pressure-glazing gaskets of elastomer type and hardness selected by the skylight manufacturer to comply with requirements. Glazing gaskets to be extruded thermoplastic elastomer by the skylight manufacturer.

D. Spacers, Edge Blocks, and Setting Blocks: Manufacturer's standard permanent non-migrating type of elastomer type and hardness selected to comply with requirements. Spacers, Edge Blocks, and Setting Blocks to be extruded thermoplastic elastomer by the skylight manufacturer.

E. Glazing Weatherseal Sealant: Neutral-curing silicone sealant recommended by skylight and sealant manufacturers for this use and furnished by skylight manufacturer.
1. Sealant is capable of withstanding 50 percent movement in both extension and compression (total of 100 percent movement) when tested for adhesion and cohesion under maximum cyclic movement according to ASTM C 719.
2. Sealant complies with ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and, as applicable to substrates including other sealants with which it comes in contact, O.
3. Color: Black.

F. Flashing Sealant: Single-component, non-sag, high performance, non-priming, gun-grade elastomeric polyurethane sealant furnished by skylight manufacturer.
1. Sealant complies with ASTM C920, Type S, Grade NS, Class 25, Use T, NT, M, A, G, and O. Canadian Specification CAN/CGSB-19.13-M87, Classification MCG-2-25-A-N.
2. Sealant conforms to USDA approval standards.

2.3 FABRICATION

A. Framing Components: As follows:
1. Factory fit and assemble components, where practical.

2. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
3. Fabricate components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.
4. Fabricate components to accommodate expansion, contraction, and field adjustment, and to provide for minimum clearance and shimming at skylight perimeter.
5. Fabricate components to ensure that glazing is thermally and physically isolated from framing members.
6. Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
7. Fit and assemble components to greatest extent practicable before finishing.
8. Reinforce members as required to retain fastener threads.
9. Attach retainer bars with gasketed stainless steel fasteners spaced at a maximum of 12 inches on center.
10. Weld components before finishing and in concealed locations to greatest extent practicable to minimize distortion.
11. Before shipping, shop assemble, mark, and disassemble components that cannot be permanently shop assembled.

B. Provide continuous aluminum frame with weatherproof splice joints and locked and sealed or fully welded corners. Locate weep holes in the frame at each rafter connection to drain condensation.
C. Prepare framing to receive anchor and connection devices and fasteners.
D. Field Glazing: Locate and size extruded elastomeric setting blocks and spacers in accordance with the glazing manufacturer's recommendations. At no point shall the glazing come in contact with the skylight frame or fasteners.

2.4 ALUMINUM FINISHES

A. General: Comply with NAAMM "Metal Finishes Manual" recommendations for application and designations of finishes.
B. Finish designations prefixed by AA conform to the system for designations of aluminum finishes established by the Aluminum Association.
    1. Mill Finish: Manufacturer's standard mill finish.
    2. 2605 Powder: Powder Coat High-Performance Architectural Coating complying with AAMA 2605. Color to match surrounding roof, and to be confirmed by Architect/Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting skylight performance.
    1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Metal Protection: As follows:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
   2. Where aluminum will contact pressure-treated wood, separate dissimilar materials by methods recommended by manufacturer.

3.3 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing skylight components.
   1. Fit frame joints to produce hairline joints free of burrs and distortion.
   2. Rigidly secure non-movement joints.
   3. Accommodate thermal and mechanical movements.
   4. Install framing components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.
   5. Coordinate installation of flashings at skylight perimeters to maintain continuity of water barriers.
   6. Set continuous curbs and flashings in a full sealant bed, unless otherwise indicated. Comply with requirements in Division 7 Section "Joint Sealants."

B. Erection Tolerances: Install skylight components true in plane, accurately aligned, and without warp or rack. Adjust framing to comply with the following tolerances:
   1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 10 feet; 1/4 inch over total length.
   2. Alignment: Where surfaces abut in line and at corners and where surfaces are separated by less than 3 inches, limit offset from true alignment to less than 1/32 inch; otherwise, limit offset from true alignment to 1/8 inch.

C. Field Glazing: Locate and size extruded elastomeric setting blocks and spacers in accordance with the glazing manufacturer's recommendations. At no point shall the glazing come in contact with the skylight frame or fasteners

D. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.

3.4 CLEANING

A. Clean skylights inside and outside, immediately after installation and after sealants have cured, according to manufacturer's written recommendations.
   1. Remove temporary protective coverings and strippable coatings from pre-finished metal surfaces. Remove labels and markings from all components.

B. Remove excess sealant according to sealant manufacturer's written recommendations.

- - END - -

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, Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

C. Hardware Sets: Section 08 06 71: DOOR HARDWARE SCHEDULE

D. Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.

E. Painting: Section 09 91 00, PAINTING.

F. Card Readers: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS.

G. Electrical: Division 26, ELECTRICAL.

H. 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. Record of opening force measurement for all doors equipped with closers

1.7 DELIVERY AND MARKING

A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to COR for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COR's office until all other similar items have been installed in project, at which time the COR will deliver items on file to Contractor for installation in predetermined locations on the project.

1.8 PREINSTALLATION MEETING

A. Convene a preinstallation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this section, including Contractor and Installer, Architect, Project Engineer and VA Locksmith, Hardware Consultant, and Hardware Manufacturer’s Representative. Review the following:

1. Inspection of door hardware.
2. Job and surface readiness.
3. Coordination with other work.
4. Protection of hardware surfaces.
5. Substrate surface protection.
6. Installation.
7. Adjusting.
8. Repair.
9. Field quality control.
10. Cleaning.

1.9 INSTRUCTIONS

A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.

B. Cylinders: Government shall provide cylinder to be keyed into existing 7 pin Corbin Russwin Grand Master Key System. Contractor shall provide locksets with cylinder housings to accommodate cylinders provided by Government.

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)

E. Architectural Barriers Act Accessibility Standards (ABAAS)

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 DOOR CLOSING DEVICES

A. Closing devices shall be products of one manufacturer.

2.3 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.

2.4 FLOOR CLOSERS AND FLOOR PIVOT SETS

A. Comply with ANSI A156.4. Provide stainless steel floor plates for floor closers and floor pivots, except where metal thresholds occur. Provide cement case for all floor closers. Floor closers specified for fire doors shall comply with Underwriters Laboratories, Inc., requirements for concealed type floor closers for classes of fire doors indicated on drawings. Hold-open mechanism, where required, shall engage when door is opened 105 degrees, except when door swing is limited by building construction or equipment, the hold-open feature shall engage when door is opened approximately 90 degrees. The hold-open mechanism shall be selectable on/off by turning a screw through the floor plate. Floor closers shall have adjustable hydraulic back-check, adjustable close speed, and adjustable latch speed. Provide closers with delayed action where a hold-open mechanism is not required. Floor closers shall be multi-sized. Single acting floor closers shall also have built in dead stop. Where required, provide closers with special cement cases appropriate for shallow deck installation or where concrete joint lines run through the floor blockout. At offset-hung doors installed in deep reveals, provide special closer arm and spindle to allow for installation. Where stone or terrazzo is applied over the floor closer case, provide closer without floor plate

and with extended spindle (length as required) and special cover pan (depth as required) to allow closer to be accessed without damaging the material applied over the closer. Pivots for non-labeled doors shall be cast, forged or extruded brass or bronze.

B. Where floor closer appears in hardware set provide the following as applicable.

1. Double Acting Floor Closers: Type C06012.
2. Single Acting Floor Closer: Type C06021 (center pivoted). (Intermediate pivot is not required).
3. Single Acting Floor Closers: Type C06041 (offset pivoted).
4. Single Acting Floor Closer for Labeled Fire Doors: Type C06051 (offset pivoted).
5. Single Acting Floor Closers For Lead Lined Doors: Type C06071 (offset pivoted).

2.5 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 Type L02251 (rubber pads having concave face) to receive turn piece or button.

D. Provide floor stops (Type L02141 or L02161) in office areas; Type L02121 x 3 screws into floor elsewhere. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width. Floor stops, where used, must be installed within 4-inches of the wall face and impact the door within the leading half of its width.

E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.

F. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.

G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.

H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.

I. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.

J. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.

K. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.

L. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

2.6 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. Cylinders: Government shall provide cylinder to be keyed into existing 7 pin Corbin Russwin Grand Master Key System. Contractor shall provide locksets with cylinder housings to accommodate cylinders provided by Government.

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. All locksets and latchsets, except on designated doors in Psychiatric (Mental Health) areas, shall have lever handles fabricated from cast stainless steel. Provide sectional (lever x rose) lever design matching existing. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Lock function F02 shall be furnished with emergency tools/keys for emergency entrance. All lock cases installed on lead lined doors shall be lead lined before applying final hardware finish. Furnish armored fronts for all mortise locks. Where mortise locks are installed in high-humidity locations or where exposed to the exterior on both sides of the opening, provide non-ferrous mortise lock case.
2. 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.

2.9 ELECTRIC STRIKES

A. ANSI/ BHMA A156.31 Grade 1.

B. General: Use fail-secure electric strikes at fire-rated doors.

2.10 KEYS

A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

Locks/Keys	Quantity
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

2.11 KEY CABINET

A. ANSI Standard A156.11. Provide key cabinet made of cold rolled, 1.2 mm (0.0478 inch) thick furniture steel electro-welded. Doors shall have "no sag" continuous brass-pin piano type hinge and be equipped with chrome plated locking door handles, hook cam and mechanical pushbutton door lock. Key Cabinet and Key Control System shall accommodate all keys for this project plus 25 percent. Provide minimum number of multiple cabinets where a single cabinet of largest size will not accommodate the required number of keys.

B. Key tags shall consist of two sets: Permanent self-locking and loan key snaphook type with tag colors as follows: Red fiber marker of the permanent self-locking type approximately 32 mm (1-1/4 inch) in diameter engraved with the legend "FILE KEY MUST NOT BE LOANED." Also furnish for each hook a white cloverleaf key marker with snap-hooks engraved with the legend "LOAN KEY."

C. The manufacturer of the lock cylinders and locks shall attach a key tag to keys of each lock cylinder and shall mark thereon the respective item number and key change number. Provide each group of keys in a key gathering envelope (supplied by Key Cabinet Manufacturer) in which the lock manufacturer shall include the following information: Item number, key change number and door number. The contractor shall furnish the Key Cabinet Manufacturer the hardware and keying schedules and change keys.

D. The Key Cabinet Manufacturer shall set up a three-way cross index system, including master keys, listing the keys alphabetically, the hooks numerically and the key changes numerically on different colored index cards. Index cards shall be typewritten and inserted in a durable binder. Attach the keys to the two sets of numbered tags supplied with the cabinet. (The permanent tag and the loan key tag). Instruct the owner in proper use of the system. Install cabinet as directed by the COR.

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.

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 FLUSH BOLTS (LEVER EXTENSION)

A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.

B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.

C. Face plates for cylindrical strikes shall be rectangular and not less than 25 mm by 63 mm (1 inch by 2-1/2 inches).

D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.

E. Provide extension rods for top bolt where door height exceeds 2184 mm (7 feet 2 inches).

2.15 FLUSH BOLTS (AUTOMATIC)

A. Conform to ANSI A156.3. Dimension of flush bolts shall conform to ANSI A115. Bolts shall conform to Underwriters Laboratories, Inc., requirements for fire door hardware. Flush bolts shall automatically latch and unlatch. Furnish dustproof strikes conforming to ANSI A156.16 for bottom flushbolt. Face plates for dustproof strike shall be rectangular and not less than 38 mm by 90 mm (1-1/2 by 3-1/2 inches).

B. At interior doors, provide auto flush bolts less bottom bolt, unless otherwise specified, except at wood pairs with fire-rating greater than 20 minutes; provide fire pins as required by auto flush bolt and door fire labels.

2.16 DOOR PULLS WITH PLATES

A. Conform to ANSI A156.6. Pull Type J401, 152 mm CTC (6 inches CTC) length by 19 mm (3/4 inches) diameter minimum with plate Type J302, 90 mm by 381 mm (3-1/2 inches by 15 inches), unless otherwise specified. Provide pull with projection of 57.2 mm (2 1/4 inches) minimum and a clearance of 38.1 mm (1 1/2 inches) minimum. Cut plates of door pull plate for cylinders, or turn pieces where required.

2.17 PUSH PLATES

A. Conform to ANSI A156.6. Metal, Type J302, 203 mm (8 inches) wide by 406.4 mm (16 inches) high. Provide metal Type J302 plates 102 mm (4 inches) wide by 406.4 mm (16 inches) high where push plates are specified for doors with stiles less than 203 mm (8 inches) wide. Cut plates for cylinders, and turn pieces where required.

2.18 COMBINATION PUSH AND PULL PLATES

A. Conform to ANSI 156.6. Type J303, stainless steel 3 mm (1/8 inch) thick, 80 mm (3-1/3 inches) wide by 800 mm (16 inches) high), top and bottom edges shall be rounded. Secure plates to wood doors with 38 mm (1-1/2 inch) long No. 12 wood screws. Cut plates for turn pieces, and cylinders where required. Pull shall be mounted down.

2.19 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.

2.20 WEATHERSTRIPS (FOR EXTERIOR DOORS)

A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length (0.000774m^3/s/m).

B. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames, lead-lined frames and frames for sound-resistant, lightproof and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

2.21 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.

2.22 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. For new buildings locate hardware on doors at heights specified below, with all hand-operated hardware centered within 864 mm (34 inches) to 1200 mm (48 inches), unless otherwise noted:

C. 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. Door opening force shall not exceed 22.2 N (5 pounds) maximum in accordance with ABAAS. Measure and adjust opening force for all doors equipped with closers.

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. DOOR HARDWARE SETS

1. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
   a. Quantities listed are for each pair of doors, or for each single door.
   b. The supplier is responsible for handing and sizing all products.
   c. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
   d. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.
2. Refer to Section 08 06 71, DOOR HARDWARE SCHEDULE for hardware sets.

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SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the following:
   1. Glass.
   2. Plastic glazing.
   3. Glazing materials and accessories for both factory and field glazed assemblies.

1.2 RELATED WORK

A. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES
B. Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES: Mirrors.
C. Section 08 52 00 ALUMINUM CLAD WOOD WINDOWS
D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Junction and Switch Boxes.

1.3 LABELS

A. Temporary labels:
   1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
   2. Label in accordance with NFRC label requirements.
   3. Temporary labels are to remain intact until glass is approved by Contracting Officer Representative (COR).
B. Permanent labels:
   1. Locate in corner for each pane.
   2. Label in accordance with ANSI Z97.1 and SGCC label requirements.
      Tempered glass.
   3. Bullet resistance glass or plastic assemblies:
      a. Bullet resistance glass or plastic assemblies in accordance with UL 752 requirements for power rating specified.
      b. Identify each security glazing permanently with glazing manufacturer's name, date of manufacture, product number, and DOS Code number inconspicuously located in lower corner on protective side and visible after glazing is framed.
      c. The "attack (threat) side" is to be identified in bold lettering on each side of glazing with removable label.

1.4 PERFORMANCE REQUIREMENTS

A. General: Design glazing system consistent with guidance and practices presented in the GANA Glazing Manual, GANA Laminated Glazing Manual, and GANA Sealant Manual, as applicable to project. Installed glazing is to withstand applied loads, thermal stresses, thermal movements, building movements, permitted tolerances, and combinations of these conditions without failure,

including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; unsafe engagement of the framing system; deflections beyond specified limits; or other defects in construction.

B. Glazing Unit Design: Design glass, including engineering analysis meeting requirements of authorities having jurisdiction. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.
   1. Design glass in accordance with ASTM E1300, and for conditions beyond the scope of ASTM E1300, by a properly substantiated structural analysis.
   2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than the structural capacity of the glazing unit, the threshold at which frame engagement is no longer safely assured, 1/100 times the short-side length

C. Ballistic- and Blast- resistant glass or plastic glazing assemblies:
   1. For blast-resistant and ballistic-resistant units comply with requirements in Physical Security Design Manual for VA Life Safety Protected Facilities, and project-specific criteria provided on the drawings and specifications.
   2. Spall Resistance: Laminated glazing is not permitted to produce spall to interior (protected side) when impacted with scheduled ballistics.
   3. Tolerances:
      a. Outside dimensions: Overall outside dimensions (height and width) of laminated security glazing is to maintain tolerance of ± 3 mm (± 0.12 inch).
      b. Warpage: Out-of-flat (warpage or bowing) condition of laminates is not to exceed 2.5 mm per lineal meter (0.10 inch per 3.3 lineal foot). The condition, if present, is to be localized to extent not greater than 0.75 mm (0.03 inch) for any 0.3 meter (0.98 feet) section.

1.5 SUBMITTALS

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

B. Sustainable Design Submittals, as described below:
   1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Manufacturer's Certificates:
   1. Certificate test reports confirming compliance with specified bullet resistive rating.
   2. Certificate that blast resistant glass meets the specified requirements.

D. Manufacturer Warranty.

E. Manufacturer's Literature and Data:
   1. Glass, each kind required.
   2. Insulating glass units.
   3. Putty, for wood sash glazing.

4. Plastic glazing material, each type required.

F. Samples:

1. Size: 305 mm by 305 mm (12 inches by 12 inches).
2. Tinted glass.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.

B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.

C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.

D. Protect laminated security glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location. Provide protective covering on exposed faces of glazing plastics, and mark inside as "INTERIOR FACE" or "PROTECTED FACE":

1. Treat security glazing as fragile merchandise and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling to comply with manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.
2. Protect sealed-air-space insulating glazing units from exposure to abnormal pressure changes, as could result from substantial changes in altitude during delivery by air freight. Provide temporary breather tubes which do not nullify applicable warranties on hermetic seals.
3. Temporary protections: The glass front and polycarbonate back of glazing are to be temporarily protected with compatible, peelable, heat-resistant film which will be peeled for inspections and re-applied and finally removed after doors and windows are installed at destination. Since many adhesives will attack polycarbonate, the film used on exposed polycarbonate surfaces is to be approved and applied by manufacturer.
4. Edge protection: To cushion and protect glass clad, and polycarbonate edges from contamination or foreign matter, the four (4) edges are to be sealed the depth of glazing with continuous standard-thickness thermoplastic rubber tape. Alternatively, continuous channel shaped extrusion of thermoplastic rubber are to be used, with flanges extending into face sides of glazing.
5. Protect "Constant Temperature" units including every unit where glass sheet is directly laminated to or directly sealed with metal-tube type spacer bar to polycarbonate sheet, from exposures to ambient temperatures outside the range of 16 to 24 degrees C (60 to 75

degrees F), during the fabricating, handling, shipping, storing, installation, and subsequent protection of glazing.

1.7 PROJECT CONDITIONS:

A. Field Measurements: Field measure openings before ordering tempered glass products to assure for proper fit of field measured products.

1.8 WARRANTY

A. Construction Warranty: Comply with the FAR clause 52.246-21 “Warranty of Construction”.

B. Manufacturer Warranty: Manufacturer shall warranty their glazing from the date of installation and final acceptance by the Government as follows. Submit manufacturer warranty.

1. Bullet resistive plastic material to remain visibly clear without discoloration for 10 years.
2. Insulating glass units to remain sealed for ten (10) years.
3. Laminated glass units to remain laminated for five (5) years.

1.9 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Architectural Manufacturers Association (AAMA):

800 ..... Test Methods for Sealants

810.1-77 ..... Expanded Cellular Glazing Tape

C. American National Standards Institute (ANSI):

Z97.1-14 ..... Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test

D. American Society of Civil Engineers (ASCE):

7-10 ..... Wind Load Provisions

E. ASTM International (ASTM):

C542-05(2017) ..... Lock-Strip Gaskets

C716-06(2020) ..... Installing Lock-Strip Gaskets and Infill Glazing Materials

C794-18 ..... Adhesion-in-Peel of Elastomeric Joint Sealants

C864-05(2019) ..... Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

C920-18 ..... Elastomeric Joint Sealants

C964-20 ..... Standard Guide for Lock-Strip Gasket Glazing

C1036-16 ..... Flat Glass

C1048-18 ..... Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

C1172-19 ..... Laminated Architectural Flat Glass

C1349-17 ..... Standard Specification for Architectural Flat Glass Clad Polycarbonate

C1376-15 ..... Pyrolytic and Vacuum Deposition Coatings on Flat Glass

D635-18 ..... Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastic in a Horizontal Position

D4802-16 ..... Poly (Methyl Methacrylate) Acrylic Plastic Sheet

E84-20..... Surface Burning Characteristics of Building Materials

E119-20..... Standard Test Methods for Fire Test of Building Construction and Material

E1300-16..... Load Resistance of Glass in Buildings

E1886-19..... Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials

E2190-19..... Insulating Glass Unit

F1233-08(2019) ..... Standard Test Method for Security Glazing Materials and Systems

F1642/F1642M-17..... Test Method for Glazing and Glazing Systems Subject to Airblast Loadings

F. Code of Federal Regulations (CFR):

16 CFR 1201-10..... Safety Standard for Architectural Glazing Materials

G. Glass Association of North America (GANA):

2010 Edition ..... GANA Glazing Manual

2008 Edition ..... GANA Sealant Manual

2009 Edition ..... GANA Laminated Glazing Reference Manual

2010 Edition ..... GANA Protective Glazing Reference Manual

H. International Code Council (ICC):

IBC ..... International Building Code

I. Insulating Glass Certification Council (IGCC)

J. Insulating Glass Manufacturer Alliance (IGMA):

TB-3001-13 ..... Guidelines for Sloped Glazing

TM-3000..... North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use

K. Intertek Testing Services – Warnock Hersey (ITS-WHI)

L. National Fire Protection Association (NFPA):

80-16 ..... Fire Doors and Windows

252-12 ..... Fire Tests of Door Assemblies

257-12 ..... Standard on Fire Test for Window and Glass Block Assemblies

M. National Fenestration Rating Council (NFRC)

N. Safety Glazing Certification Council (SGCC) 2012:
Certified Products Directory (Issued Semi-Annually).

O. Underwriters Laboratories, Inc. (UL):
9-08(R2009) ..... Fire Tests of Window Assemblies
263-14 ..... Fire Tests of Building Construction and Materials
752-11 ..... Bullet-Resisting Equipment.

P. Department of Veterans Affairs:

Q. Physical Security Design Manual for VA Life Safety Protected Facilities October 2020

R. Architectural Design Manual for VA Facilities (VASDM)

S. Environmental Protection Agency (EPA):
40 CFR 59(2014) ..... National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCT

2.1 GLASS

A. Provide minimum thickness stated and as additionally required to meet performance requirements.
   1. Provide minimum 6 mm (1/4 inch) thick glass units unless otherwise indicated.

B. Obtain glass units from single source from single manufacturer for each glass type.

C. Clear Glass:
   1. ASTM C1036, Type I, Class 1, Quality q3

2.2 HEAT-TREATED GLASS

A. Roller Wave Limits for Heat-Treated Glass: Orient all roller wave distortion parallel to bottom surface of glazing, and provide units complying with the following limitations:
   1. Measurement Parallel to Line: Maximum peak to valley 0.203 mm (0.008 inch).
   2. Measurement Perpendicular to Line: Maximum 0.0254 mm (0.001 inch).
   3. Bow/Warp: Maximum 50 percent of bow and warp allowed by ASTM C1048.

B. Clear Tempered Glass:
   1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.

2.3 PLASTIC GLAZING

Thickness	Long Dimension of Sheet
3 mm (0.125 inch)	610 mm (24 inches or less)
5 mm (0.187 inch)	610 - 915 mm (24 through 36 inches)
6.5 mm (0.250 inch)	915 – 1524 mm (36 through 60 inches)

1. For polycarbonate use not less than the following minimum thickness:

Thickness	Long Dimension of Sheet	Edge Lap
3 mm (0.125 inch)	610 – 1219 mm (24 through 48 inches)	19 mm (3/4 inch)
9.5 mm (0.375 inch)	1219 – 1524 mm (48 through 60 inches)	25 mm (3/4 inch)
13 mm (Over 0.50 inch)	1524 mm (Over 60 inches)	25 mm (1 inch)

2. Check: Window, door, and plastic manufacturer for glazing rabbet depth allowing for expansion and edge lap required for plastic.
3. Acrylic plastics have flame spreads that limit use on interior spaces.

A. Clear Polycarbonate Sheet:
   1. ASTM C1349, Appendix X1, Type II, (coated mar-resistant, UV stabilized), with coating on both sides. Flame spread of 10 or less when tested per ASTM E84.
   2. Thickness, as scheduled.

2.4 LAMINATED GLAZING

A. Laminated Glass: ASTM C1172. One interior lite of heat-treated glass bonded with polyvinyl butyral, ionomeric polymer, or cast-in-place and cured-transparent-resin interlayer complying with interlayer manufacturer's written instructions. Minimum total laminated thickness of 1/4” for blast resistant glazing.

B. Interlayer: Use min. 0.75 mm (0.030 inch) thick interlayer for vertical glazing unless otherwise scheduled.

C. Interlayer: Use 1.5 mm (0.060 inch) thick interlayer for:
   1. Assemblies requiring heat strengthened or fully tempered glass.

D. Interlayer: Use 2.28 mm (0.090 inch) thick interlayer where required to meet performance requirements.

E. Interlayer Color: Clear, unless otherwise scheduled.

2.5 SECURITY GLAZING ASSEMBLY

A. Provide ballistic level as scheduled in accordance with UL 752.

B. Blast Resistance: Provide exterior glazing units that meet the specified blast pressures and impulses providing protection based upon hazard rating as scheduled, in accordance with

Physical Security and Resilience Design Manual for Life Safety Protected Facilities) October 2020 as indicated in Specification Section 08 56 53.

D. Laminated Glass Security Glazing Units: Fabricate from multiple lites of scheduled glass with polyvinyl butyral, ionomeric polymer, or cast-in-place and cured-transparent resin interlayers between the layers of glazing.

2.6 INSULATING GLASS UNITS

A. Provide factory fabricated, hermetically sealed glass unit consisting of two panes of glass separated by a dehydrated air space and comply with ASTM E2190. The exterior glass unit shall be fully tempered and the inner glass unit shall be laminated annealed at a minimum for all blast resistant glazing.

B. Assemble units using glass types specified in Insulating Glass Schedule and Blast Glazing assembly requirements

2.7 GLAZING ACCESSORIES

A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work are to have a finish that will not corrode or stain while in service.

B. Setting Blocks: ASTM C864:
   1. Silicone type.
   2. Channel shape; having 6 mm (1/4 inch) internal depth.
   3. Shore A hardness of 80 to 90 Durometer.
   4. Block lengths: 50 mm (2 inches) except 100 to 150 mm (4 to 6 inches) for insulating glass.
   5. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
   6. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.

C. Spacers: ASTM C864:
   1. Channel shape having a 6 mm (1/4 inch) internal depth.
   2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
   3. Lengths: 25 to 76 mm (1 to 3 inches).
   4. Shore A hardness of 40 to 50 Durometer.

D. Glazing Tapes:
   1. Semi-solid polymeric based closed cell material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
   2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
   3. Complying with AAMA 800 for the following types:
      a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
      b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

E. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.

F. Glazing Gaskets: ASTM C864:
   1. Firm dense wedge shape for locking in sash.
   2. Soft, closed cell with locking key for sash key.
   3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.

G. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.

H. Glazing Sealants: ASTM C920, silicone neutral cure:
   1. Type S.
   2. Class 25 or 50 as recommended by manufacturer for application.
   3. Grade NS.
   4. Shore A hardness of 25 to 30 Durometer.
   5. VOC Content: For sealants used inside the weatherproofing system, not more than 250 g/L or less when calculating according to 40 CFR 59, (EPA Method 24).

I. Neoprene, EPDM, or Vinyl Glazing Gasket: ASTM C864.
   1. Channel shape; flanges may terminate above the glazing channel or flush with the top of the channel.
   2. Designed for dry glazing.

J. Color:
   1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames to match color of the finished aluminum and be nonstaining.
   2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted are to be black, gray, or neutral color.

K. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units intended for removal for smoke control. Comply with requirements of local Fire Department.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
   2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer is approved shop drawings.

B. Review for conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units.

3.2 PREPARATION

A. For sealant glazing, prepare glazing surfaces in accordance with GANA Sealant Manual.

B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.

C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.

D. Verify that components used are compatible.

E. Clean and dry glazing surfaces.

F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

3.3 INSTALLATION – GENERAL

A. Install in accordance with GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, and IGMA TM-3000 unless specified otherwise.

B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.

C. Set glazing without bending, twisting, or forcing of units.

D. Do not allow glass to rest on or contact any framing member.

E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.

F. Laminated Glass:

1. Tape edges to seal interlayer and protect from glazing sealants.
2. Do not use putty or glazing compounds.

G. Insulating Glass Units:

1. Glaze in compliance with glass manufacturer's written instructions.
2. When glazing gaskets are used, they are to be of sufficient size and depth to cover glass seal or metal channel frame completely.
3. Do not use putty or glazing compounds.
4. Do not grind, nip, cut, or otherwise alter edges and corners of fused glass units after shipping from factory.
5. Install with tape or gunnable sealant in wood sash.

3.4 REPLACEMENT AND CLEANING

A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by COR.

B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.

C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

3.5 PROTECTION

A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

3.6 LAMINATED GLASS SCHEDULE

A. Glass Type: Low-E-coated, laminated vision glass with one (1) interior lite of clear, heat-strengthened, fully tempered float glass.
   1. Minimum Thickness of Each Glass Lite: 3 mm (0.12 inch)
   2. Interlayer Thickness: 0.76 mm (0.030 inch) minimum.
   3. Low-E Coating: Sputtered on second surface.
   4. Visible Light Transmittance: 48 percent minimum.
   5. Solar Heat Gain Coefficient: 0.26 maximum.
   6. Safety glazing label required.

3.7 INSULATING GLASS SCHEDULE

A. Glass Type: Low-E-coated, clear insulating glass.
   1. Overall Unit Thickness: 25 mm (1 inch).
   2. Minimum Thickness of Each Glass Lite: 3 mm (0.12 inch)
   3. Outdoor Lite: Annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
   4. Interspace Content: Argon.
   5. Indoor Lite: Fully tempered float glass.
   6. Low-E Coating: Sputtered on second surface.
   7. Visible Light Transmittance: 68 percent minimum
   8. Solar Heat Gain Coefficient: 0.38 maximum
   9. Safety glazing label required

3.8 SECURITY GLAZING SCHEDULE

A. Clear Tempered Glass Clad Polycarbonate Security Glazing Unit:
   1. Outer Glass Panes: Fully tempered, 3 mm (0.12 inch) thick.
   2. Interlayers: Minimum 1.3 mm (0.050 inch) polyurethane sheeting, in thickness required to meet performance requirements.
   3. Core: Clear polycarbonate sheet, minimum 3 mm (0.12 inch) thick, in thickness required to meet performance requirements.
   4. Blast Resistance: Provide units are in accordance with Physical Security and Resilience Design Manual for Life Safety Protected Facilities) October 2020 as indicated in Specification Section 08 56 53.

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SECTION 08 87 00

SECURITY GLAZING FILM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the following:

1. Security Glazing film applied to existing glazing assemblies as identified in the Construction Documents.

1.2 SUBMITTALS

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

B. Test Reports: Detailed reports of full-scale chamber tests to specified criteria, using assemblies commensurate with those required for this project.

C. Manufacturer’s Literature and Data: Manufacturer's data sheets on product to be used, including:

1. Record of product certification for safety requirements.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

D. Samples: For each film product to be used, minimum size 4-inches by 6-inches, representing actual product, color, and patterns.

E. Manufacturer Warranty.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store products as directed in manufacturer’s unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of authorities having jurisdiction.

1.4 FIELD CONDITIONS

A. Coordinate installation timeline with General Contractor’s and/or COR’s schedule and potential other adjacent work that may create or cause adverse installation conditions.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer’s absolute limits.

C. Field Measurements: Field measure openings before ordering tempered glass products to assure for proper fit of field measured products.

1.5 WARRANTY

A. Construction Warranty: Comply with the FAR clause 52.246-21 “Warranty of Construction”.

B. Manufacturer Warranty: Manufacturer shall warranty their film from the date of installation and final acceptance by the Government as follows. Submit manufacturer warranty.

a. Provide 15 Year manufacturers replacement warranty to cover film against peeling, cracking, discoloration, and deterioration

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Glazing film manufacturer specializing in manufacture of security glazing films with minimum 5 years' experience manufacturing products meeting specified requirements.

B. Installer Qualifications: Direct employees of film manufacturer or manufacturer-approved installers trained in all aspects of film installation.

C. Field Mockup: Apply security glazing film in location(s) as directed to verify installation requirements and to demonstrate application effects and qualities of materials and execution.

1. Obtain approval of field samples before continuing with remainder of installation.
2. Maintain mockup during duration of installation in an undisturbed condition as a standard for judging the completed Work.
3. Approved field mockup may become part of the completed Work.

D. Film application and performance verification:

1. In addition to only proceeding with reviewed and approved submittals, the awarded contractor/ installer shall certify that the security film installed meets the performance requirements identified within the Construction Documents.
2. Post installation film verification may include the random choosing and removal of up to three pieces of glass with applied film to be tested to verify that film installed meets specification and performance requirements as indicated. Film may need to be removed as part of the verification process.
3. All installed film locations shall be subject to inspection of structural sealant to verify full bite on frames has been achieved.

1.7 APPLICABLE PUBLICATIONS

A. American National Standards Institute (ANSI)

1. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; Current Version.

B. American Society for Testing and Materials (ASTM)

1. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials; Current Version.
2. ASTM F3561.- Standard Test Method for Forced-Entry-Resistance of Fenestration Systems After Simulated Active Shooter Attack. FTD SA – FILTI Shooter Attack Certification Testing, Filti Testing and Development Shooter Attack Certification.
3. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings.

C. Code of Federal Regulations

1. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: 3M Safety and Security Window Film Safety Series – Safety S140

B. Substitutions: Must provide demonstrated equality to specified basis of design product and performance requirements.

2.2 MATERIALS

A. Security Glazing Film

1. Single thickness minimum 14 mil (0.36 mm) thick, clear, UV stable, optically transparent, adhesive backed polyester film for permanent bonding to glass.
   a. Installing multiple layers of thinner film to accomplish the required thickness is not acceptable nor considered equal to the basis of design.
2. Adhesive Type: Pressure sensitive as recommended by glazing film manufacturer.
3. Performance Requirements: in accordance with ASTM F1642
   a. Tensile Strength: 25,000 psi minimum.
   b. Breaking Strength: 350 lbs. / inch.
   c. Elongation at Break: >125%
   d. Abrasion Resistance: <5%
   e. Visible Light Transmittance: minimum 70%
4. Cleaners, Primers, and Sealers: Types recommended by glazing film manufacturer.

B. Anchoring System

1. Structural Sealant: Per manufacturer's recommendations for the installation application.
2. Provide supplemental anchoring system components as required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field-Applied Film: Verify that existing conditions are adequate for proper application and performance of film.

B. Examine glass and frames, ensure that existing conditions are adequate for proper application and performance of film.

C. Verify glass is not cracked, chipped, broken, or damaged.

D. Verify that frames are securely anchored and free of defects.

3.2 PREPARATION

A. Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.

B. Blade the inside surface of window glass with industrial razors to ensure removal of foreign contaminants.

C. Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.

D. Protect adjacent surfaces.

E. Do not begin installation until substrates have been properly prepared.

3.3 INSTALLATION

A. Install to inside face of glass, in accordance with manufacturer's instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps, as required to achieve specified performance.

B. Seams: Seam film only as required to accommodate material sizes, seam without overlaps. Seam orientation to be identified and coordinated during shop drawing review and verified in field prior to installation.

C. Apply bead of structural sealant overlapping 3/4-inch of the exposed edge of film and overlapping 3/4-inch of glazing system frame. Allow to cure before cleaning.

D. Clean glass and excess structural sealants from finished surfaces.

E. Remove any labels or protective covers. Do not encapsulate anything under the film.

3.4 PROTECTION

A. Protect installed products until completion and final acceptance of project.

B. Repair or replace damaged products before Substantial Completion.

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SECTION 08 90 00
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies fixed wall louvers and wall vents.

1.2 RELATED WORK

A. Section 09 06 00, SCHEDULE FOR FINISHES: Color of finish.

1.3 SUBMITTALS

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

B. Shop Drawings:

1. Each type, showing material, finish, size of members, method of assembly, and installation and anchorage details.

C. Manufacturer's Literature and Data:

1. Each type of louver and vent.

D. Color samples.

E. Blast Design Calculations: Louver System and Anchorage

1. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years experience in design of blast resistant window systems, verifying louver assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1, W2 and GP1, GP2 are defined in the Physical Security Design Standards Data Definitions which is a document separate from the referenced VA Security Design Manual. The Physical Security Design Standards Data Definitions are provided on a need to know basis by the blast/structural engineer performing the blast design on VA projects. It is the responsibility of the engineer of blast resistant windows to request and obtain the Physical Security Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

1.4 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The Master Painters Institute (MPI):
Approved Product List – Updated Monthly

C. ASTM International (ASTM):
B209-14.....Aluminum and Aluminum Alloy, Sheet and Plate
B209M-14.....Aluminum and Aluminum Alloy, Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

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

D1187/D1187M-97(2018) .....Asphalt-Base Emulsions for Use as Protective Coatings for Metal

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

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

E. National Fire Protection Association (NFPA):

90A-15.....Installation of Air Conditioning and Ventilating Systems

F. American Architectural Manufacturers Association (AAMA):

2605-13 .....High Performance Organic Coatings on Architectural Extrusions and Panels

G. Air Movement and Control Association, Inc. (AMCA):

500-L-07 Testing Louvers

H Department of Veterans Affairs:

VA Physical Security Design Manual for Life Safety Protected Facilities January 2015

I. Protective Design Center

PDC-TR-08 Single Degree of Freedom Structural Response Limits for Antiterrorism Design

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Aluminum, Extruded: ASTM B221M (B221).

B. Aluminum, Plate and Sheet: ASTM B209M (B209); alloy 3003 or 5005 with temper as required for forming.

C. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or indicated in construction documents, to be toggle or expansion bolts of size and type as required for each specific type of installation and service condition.

1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
2. Fasteners for louvers, louver frames, and wire guards to be of aluminum with same finish as louvers.
3. Fasteners for louvers, louver frames and wire guards within mental health areas to be non-removable/tamper-proof type.

D. Inorganic Zinc Primer: MPI No. 19.

2.2 EXTERIOR WALL LOUVERS:

A. General:

1. Provide fixed type louvers of size and design shown.

2. Heads, sills and jamb sections are to have formed caulking slots or be designed to retain caulking. Head sections are to have exterior drip lip, and sill sections an integral water stop.
3. Furnish louvers with sill extension or separate sill as shown.
4. Frame is to be mechanically fastened or welded construction with welds dressed smooth and flush.

B. Performance Characteristics:
1. Weather louvers are to have a minimum of 39 percent free area and to pass 1250 fpm free area velocity at a pressure drop not exceeding 30 inch water gauge and carry not more than 0.1 ounces of water per square foot of free area for 15 minutes when tested per AMCA Standard 500-L.
2. Louvers are to bear AMCA certified rating seals for air performance and water penetration ratings.
3. Blast Resistance:
A. Louvers in exterior walls shall be blast resistant and meet the following criteria per the VA Physical Security Design Manual for Life Safety Protected Facilities January 2015:
1. Standoff Distance: 25 feet (Life Safety Protected)
a. Design Threat W1 at the standoff distance not to exceed pressure and impulse associated with GP1 threat for Life Safety Protected Buildings.
b. Deformation not to exceed those defined by B3 response per the Protective Design Center document PDC-TR-08 while experiencing design level pressures.

C. Aluminum Louvers:
1. General: Frames, blades, sills and mullions (sliding interlocking type); 2 mm (0.078-inch) thick extruded 6063-T5 or –T52 aluminum. Blades to be drainable type and have reinforcing bosses.
2. Louvers, fixed: Make frame sizes 13 mm (1/2-inch) smaller than openings. Single louvers frames are not to exceed 1676 mm (66 inches) wide. When openings exceed 1676 mm (66 inches), provide twin louvers separated by mullion members.
3. Louvers are to withstand the effects or gravity loads and the following wind loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors.
a. Wind load acting inward or outward of not less than 1436 Pa (30 pound per square foot.).

2.3 CLOSURE ANGLES AND CLOSURE PLATES:

A. Fabricate from 2 mm (0.078-inch) thick aluminum.
B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.

C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as indicated in construction documents.

2.4 WIRE GUARDS:

A. Provide wire guards on outside of all exterior louvers, except on exhaust air louvers.

B. Fabricate frames from 2 mm (0.078-inch) thick extruded or sheet aluminum designed to retain wire mesh.

C. Wire mesh to be woven from not less than 1.6 mm (0.063-inch) diameter aluminum wire square mesh.

D. Miter corners and join by concealed corner clips or locks extending not less than 57 mm (2-1/4 inches) into rails and stiles. Equip wire guards over 1219 mm (4 feet) in height with a mid-rail constructed as specified for frame components.

E. Fasten frames to outside of louvers with aluminum devices of same finish as louvers designed to allow removal and replacement without damage to the wire guard or the louver.

2.5 WALL VENTS:

A. Fabricate exterior wall vents from 4.7 mm (0.185-inch) thick aluminum plate, perforated in diamond lattice pattern, with not over 19 mm (3/4-inch) openings.

B. Vents are to have aluminum screen frame with aluminum alloy insect screening mounted on back of vent by means of 19 mm x 5 mm (3/4-inch by 3/16-inch) top and bottom bars screwed to grille.

C. Vent Frames in Masonry: Fabricate of 45 mm x 30 mm x 5 mm (1-3/4 inch by 1-1/4 inch by 3/16-inch) steel angles bolted with 6 mm (1/4-inch) diameter expansion bolts at jambs.

2.6 AIR INTAKE VENTS:

A. Fabricate exterior louvered wall ventilators for fresh air intake for air conditioning units from extruded aluminum, ASTM B221M (B221). Form with integral horizontal louvers and frame, with drip extending beyond face of wall and integral water stops.

2.7 FINISH:

A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505

B. Aluminum Louvers: Air Intake Vents, Wire Guards:

1. Organic Finish: AAMA 2605 (Fluorocarbon coating) with total dry film thickness of not less than 0.03 mm (1.2 mil), color as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.

2.8 PROTECTION:

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous coating (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.

B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.

C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work. Strippable plastic coating on organic finish is not approved.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Set work accurately, in alignment and where indicated in construction documents. Install plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.

C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers and vents to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.

D. Set wall louvers and vents in masonry walls during progress of the work. If wall louvers and vents are not delivered to job in time for installation in prepared openings, make provision for later installation. Set in cast-in-place concrete in prepared openings.

3.2 CLEANING AND ADJUSTING:

A. After installation, all exposed prefinished and plated items and all items fabricated from aluminum are to be cleaned as recommended by the manufacturer and protected from damage until completion of the project.

B. All movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Contracting Officer Representative (COR) damaged units and replace with new units.

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SECTION 09 05 16
SUBSURFACE PREPARATION FOR FLOOR FINISHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies subsurface preparation requirements for areas to receive the installation of applied and resinous flooring. This section includes removal of existing floor coverings, testing concrete for moisture and pH, remedial floor coating for concrete floor slabs having unsatisfactory moisture or pH conditions, floor leveling and repair as required.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS.

B. Section 09 65 19, RESILIENT TILE FLOORING

C. Section 09 68 00, CARPETING

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
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. 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.

K. 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.

L. 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.

- - - E N D - - -

SECTION 09 06 00
SCHEDULE FOR FINISHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.

1.2 MANUFACTURERS

A. Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

1.3 SUBMITALS

A. Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES-provide quadruplicate samples for color approval of materials and finishes specified in this section.

1.4 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. MASTER PAINTING INSTITUTE: (MPI)
6/1/2019 .....Architectural Painting Specification Manual

PART 2 - PRODUCTS

2.1 SEE FINISH SCHEDULE INCLUDED IN CONSTRUCTION DOCUMENTS

PART 3 - EXECUTION

3.1 FINISH SCHEDULES & MISCELLANEOUS ABBREVIATIONS

FINISH SCHEDULE & MISCELLANEOUS ABBREVIATIONS	
Term	Abbreviation
Access Flooring	AF
Accordion Folding Partition	AFP
Acoustical Ceiling	AT
Acoustical Ceiling, Special Faced	AT (SP)
Acoustical Metal Pan Ceiling	AMP
Acoustical Wall Panel	AWP
Acoustical Wall Treatment	AWT
Acoustical Wallcovering	AWF
Anodized Aluminum Colored	AAC
Anodized Aluminum Natural Finish	AA
Baked On Enamel	BE
Brick Face	BR
Brick Flooring	BF
Brick Paving	BP
Carpet	CP
Carpet Athletic Flooring	CAF
Carpet Module Tile	CPT
Ceramic Glazed Facing Brick	CGFB
Ceramic Mosaic Tile	FTCT
Concrete	C
Concrete Masonry Unit	CMU
Divider Strips Marble	DS MB
Epoxy Coating	EC
Epoxy Resin Flooring	ERF
Existing	E
Exposed Divider Strips	EXP
Exterior	EXT
Exterior Finish System	EFS
Exterior Paint	EXT-P
Exterior Stain	EXT-ST
Fabric Wallcovering	WF
Facing Tile	SCT
Feature Strips	FS
Floor Mats & Frames	FM
Floor Tile, Mosaic	FT
Fluorocarbon	FC
Folding Panel Partition	FP
Foot Grille	FG
Glass Masonry Unit	GUMU
Glazed Face CMU	GCMU
Glazed Structural Facing Tile	SFTU
Granite	GT
Gypsum Wallboard	GWB
High Glazed Coating	SC
Latex Mastic Flooring	LM
Linear Metal Ceiling	LMC
Linear Wood Ceiling	LWC

Marble	MB
Material	MAT
Mortar	M
Multi-Color Coating	MC
Natural Finish	NF
Paint	P
Paver Tile	PVT
Perforated Metal Facing (Tile or Panels)	PMF
Plaster	PL
Plaster High Strength	HSPL
Plaster Keene Cement	KC
Plastic Laminate	HPDL
Polypropylene Fabric Wallcovering	PFW
Porcelain Paver Tile	PPT
Quarry Tile	QT
Radiant Ceiling Panel System	RCP
Resilient Stair Tread	RST
Rubber Base	RB
Rubber Tile Flooring	RT
Spandrel Glass	SLG
Stain	ST
Stone Flooring	SF
Structural Clay	SC
Suspension Decorative Grids Grids	SDG
Terrazzo Portland Cement	PCT
Terrazzo Tile	TT
Terrazzo, Thin Set	

Textured Gypsum Ceiling Panel	TGC
Textured Metal Ceiling Panel	TMC
Thin set Terrazzo	TST
Veneer Plaster	VP
Vinyl Base	VB
Vinyl Coated Fabric Wallcovering	W
Vinyl Composition Tile	VCT
Vinyl Sheet Flooring	VSF
Vinyl Sheet Flooring (Welded Seams)	WSF
Wall Border	WB
Wood	WD

3.2 FINSIH SCHEDULE SYMBOLS

Symbol	Definition
**	Same finish as adjoining walls
-	No color required
E	Existing
XX	To match existing
EFTR	Existing finish to remain
RM	Remove

3.3 FINISH SCHEDULE

A. Match adjoining or existing similar surfaces colors, textures or patterns where disturbed or damaged by alterations or new work when not scheduled.

--- E N D---

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. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.

B. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS and Section 09 29 00, GYPSUM BOARD.

1.3 TERMINOLOGY

A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.

C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

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

B. Manufacturer's Literature and Data:

1. Studs, runners and accessories.
2. Hanger inserts.
3. Channels (Rolled steel).
4. Furring channels.
5. Screws, clips and other fasteners.

C. Shop Drawings:

1. Typical ceiling suspension system.
2. Typical metal stud and furring construction system including details around openings and corner details.
3. Typical shaft wall assembly
4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.

D. Test Results: Fire rating test designation, each fire rating required for each assembly.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society For Testing And Materials (ASTM)

A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire

A653/653M-11.....Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

C11-10.....Terminology Relating to Gypsum and Related Building Materials and Systems

C635-07 .....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings

C636-08 .....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

C645-09 .....Non-Structural Steel Framing Members

C754-11 .....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

C841-03(R2008) .....Installation of Interior Lathing and Furring

C954-10 .....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

E580-11.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

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.

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,

F. At existing plaster ceilings and where shown, studs may terminate at ceiling as shown.

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 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.

F. Elevator Shafts:

1. Frame elevator door frames with 0.87 mm (0.0341-inch) thick J strut or J stud jambs having 75 mm (three-inch) long legs on the shaft side.
2. 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.
3. Align shaft walls for plumb vertical flush alignment from top to bottom of shaft.

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 can not be accomplished.
D. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.
E. Existing concrete construction exposed or concrete on steel decking:
   1. Use power actuated fasteners either eye pin, threaded studs or drive pins for type of hanger attachment required.
   2. Install fasteners at approximate mid height of concrete beams or joists. Do not install in bottom of beams or joists.
F. Steel decking without concrete topping:
   1. Do not fasten to steel decking 0.76 mm (0.0299-inch) or thinner.
   2. Toggle bolt to decking 0.9 mm (0.0359-inch) or thicker only where anchorage to steel framing is not possible.
G. 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.

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.)

- - - E N D - - -

SECTION 09 23 00
GYPSUM PLASTERING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies metal and gypsum lathing and gypsum plaster.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 08 31 13, ACCESS DOORS AND FRAMES: Access Doors.

C. Section 09 22 16, NON-STRUCTURAL METAL FRAMING Steel framing members for attachment of plaster bases.

D. Section 09 06 00, SCHEDULE FOR FINISHES: Room finish schedule.

1.3 TERMINOLOGY

A. Definitions and description of terms to be in accordance with ASTM C11, ASTM C841, and ASTM C842 and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead is the underside of the floor or roof construction supported by beams, trusses, and bar joists.

C. Self-furring Lath: Metal plastering bases having dimples or crimps designed to hold the back plane of the lath 6 to 10 mm (1/4 to 3/8 inch) away from the plane of the solid backing.

D. Solid Backing or Solid Bases: Concrete, masonry, sheathing, rigid insulation, and similar materials to which plaster is directly applied.

E. Wet Areas: Areas of a building where cyclic or continuous exposure to very humid or wet conditions, or in which a dew point condition may occur in the plaster.

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. Postconsumer and preconsumer recycled content as described in PART 2 - PRODUCTS.

C. Shop Drawings:

1. Details of floating interior angle unrestrained construction.
2. Details of assembly and anchorage of lath and accessories.

D. Manufacturers' Literature and Data:

1. Accessories for plaster, each type.
2. Metal plaster bases, each type.
3. Fasteners.
4. Bonding compounds, including application instructions.

5. Admixtures, including mixing and application instructions.

E. Manufacturers certificates:

1. Gypsum plaster.

F. Samples: Accessories for plaster, each type, not less than 152 mm (6 inches) long.

G. Panel showing finish coat, 152 by 305 mm (6 by 12 inches) minimum.

H. Installer qualifications.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Deliver manufactured materials in the manufacturers' original unbroken packages or containers which are labeled plainly with the manufacturers' names and brands. Keep cementitious materials dry and stored off the ground, under cover, and away from sweating walls and other damp surfaces until ready for use.

1.6 PROJECT CONDITIONS

A. Comply with ASTM C842 requirements.

B. Maintain work areas at not less than 13 degrees C (55 degrees F) or greater than 27 degrees C (80 degrees F) for not less than one (1) week prior to application of plaster, continuously during application of plaster, and one (1) week after plaster has set or until plaster has dried.

1.7 QUALITY ASSURANCE

A. Installers qualifications: Work to be performed by installer having a minimum of three (3) years' experience for work relating to this Section.

B. Mockup: Build 10 square feet mockup of each substrate and finish texture indicated for gypsum plastering, including accessories. Simulate finished lighting conditions for review of mockups. Approved mockups may become part of completed work.

1.8 PERFORMANCE REQUIREMENTS

A. Where indicated on construction documents, provide gypsum plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E119 by a qualified testing agency.

B. Where indicated on construction documents provide gypsum plaster assemblies identical to those of assemblies tested for STC ratings according to ASTM E90 and classified according to ASTM E413 by a qualified testing agency.

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 basic designation only.

B. ASTM International (ASTM):

A641/A641M-19 .....Zinc-Coated (Galvanized) Carbon Steel Wire
A653/A653M-20 .....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
C11-18b .....Terminology Relating to Gypsum and Related Building Materials and Systems.
C28/C28M-10(2020) .....Gypsum Plasters
C35-01(2019) .....Inorganic Aggregates For Use in Gypsum Plaster
C206-14 .....Finishing Hydrated Lime
C472-20 .....Physical Testing of Gypsum, Gypsum Plaster and Gypsum Concrete
C631-09(2020) .....Bonding Compounds for Interior Gypsum Plastering
C841-03(2018) .....Installation of Interior Lathing and Furring
C842-05(2015) .....Application of Interior Gypsum Plaster
C847-18 .....Metal Lath
C1002-18 .....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
D3678-19 .....Rigid Poly (Vinyl Chloride) (PVC) Interior-Profile Extrusions
E413-16.....Classification for Rating Sound Insulation
E90-09(2016) .....Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

C. Commercial Item Description (CID):
A-A-55615-95(R2006).....Shield, Expansion; (Wood Screw and Log Bolt Self-Threading Anchor)

PART 2 - PRODUCTS

2.1 PLASTERING BASES (LATH)

A. Expanded-Metal Lath: ASTM C847, cold-rolled carbon-steel sheet with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.
   1. Paper Backing: Kraft paper factory bonded to back of lath.
   2. Diamond-Mesh Lath:
      a. Type: furring.
      b. Weight: 1.8 kg/square meter (3.4 pound square yard.
   3. Flat-Rib Lath: Rib depth of not more than 3 mm (1/8 inch), 1.8 kg/square meter (3.4 pound square yard).
   4. 10 mm (3/8-inch) Rib Lath: 2.2 kg/square meters (4 pound/square yard).
   5. Recycled Content of Metal Products: Post-consumer plus one-half of preconsumer content not less than 30 percent.

B. Gypsum Lath:
   1. Sheet; 610 mm x 2438 mm (2 feet. x 8 feet.).
   2. 10 mm (3/8 inch) thick.
   3. Type “X” for fire rated assemblies.

2.2 GYPSUM PLASTERS

A. Base Coat: High strength gypsum plaster with a minimum average, dry compressive strength of 19 MPa (2800 psi) according to ASTM C472 for a mix of 45 kg (100 pounds) of plaster and .06 cubic meter (2 cubic feet) of sand.

B. Finish Coat: High strength gypsum gauging plaster with a minimum average dry compressive strength of 34 MPa (5000 pounds square inch) according to ASTM C472.

2.3 LIME

A. ASTM C206, Type S.

2.4 AGGREGATES:

A. Natural sand, except grade aggregates in accordance with ASTM C35, "TABLE 1".

B. Vermiculite and perlite aggregates are not acceptable, except where required for fire rated assemblies.

2.5 BONDING COMPOUND (FOR INTERIOR WORK)

A. ASTM C631, except water re-emulsifiable compound is prohibited.

2.6 ACCESSORIES FOR GYPSUM PLASTER

A. General: Coordinate depth of trim and accessories with thicknesses and number of plaster coats required as per ASTM C841.

B. Cornerite: Fabricated from expanded-metal lath with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.

C. Striplath: Fabricated from expanded-metal lath with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.

D. Cornerbeads: Fabricated from zinc-coated (galvanized) steel.
   1. Smallnose cornerbead with expanded flanges; use unless otherwise indicated on construction documents.
   2. Smallnose cornerbead with perforated flanges; use on curved corners.
   3. Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
   4. Bullnose cornerbead, radius 19 mm (3/4 inch) minimum, with expanded flanges; use at locations indicated on construction documents.

E. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.

F. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

2.7 FASTENERS

A. Tie wire, screws, staples, clips, nails, and other fasteners ASTM C841, except as otherwise specified.

B. Provide fasteners for securing metal plastering bases having heads, or inserted through washers large enough to engage two strands (1 on each side of the washer) of the metal plastering base.

C. For fire rated construction type and size as used in fire rated test.

D. Screws: ASTM C1002.

E. Expansion Shields: CID A-A-55615.

PART 3 - EXECUTION

3.1 APPLYING LATH BASES

A. Apply lath base in accordance with ASTM C841, except as otherwise specified or shown.

B. Provide metal plastering bases where plaster is required on partitions, ceilings and furring, and for light troughs, beams and other curved or irregular surfaces.

1. Where plaster is required on solid bases, metal plastering bases are not required, unless shown on the construction documents.
2. Form true surfaces, straight or in moderate curves where shown on construction documents, without sags or buckles and with long dimension of lath at right angles to direction of supports.
3. Shape lathing to within 19 mm (3/4 inch) of finished profiles of irregular surfaces.
4. Terminate lath for ceiling construction at casing bead (Floating Angle Construction) where butting into or penetrated by walls, columns, beams, and similar elements.

C. Gypsum lath may be used in lieu of expanded metal lath for gypsum plaster only on straight flat surfaces of partitions and walls, and on furring, except for lathing in wet areas and as a base for marble finishes.

D. Installing Metal Plastering Bases:

1. Select type of expanded metal lath to conform to Table 2 of ASTM C841.
2. Select type of fasteners based upon expanded metal lath type to be installed to conform to Table 1 of ASTM C841.
3. Where metal plastering bases are required over solid backing, provide self-furring, diamond-mesh lath type.
4. Attach self-furring diamond-mesh lath directly to masonry and concrete with hardened nails, power actuated drive pins. Locate fasteners at the dimples or crimps only.
5. Where metal plastering bases are required over steel columns and studless solid plaster partitions supports by L-runners, provide rib lath.

6. Provide rib lath above ceramic title wainscots where the finish above the wainscot is required to finish flush with the tile face.
7. Do not install continuous plastering bases through expansion and control joints. Terminate plastering base at each side of joint.

3.2 SURFACE PREPARATION OF SOLID BASES

A. Prepare in accordance with ASTM C842, except as otherwise specified.
B. Terminate concrete form ties and other metal projections not less than 3.2 mm (1/8 inch) below the surface of concrete.
C. Remove projections and fill depressions, holes, cracks and similar voids flush with patching compound compatible with the substrate and plaster, within the tolerance, specified in ASTM C842.
D. Clean existing concrete surfaces specified to receive plaster to ensure bonding as specified in ASTM C842.
E. Condition new or existing concrete surfaces specified to receive plaster by applying bonding compound as specified in ASTM C842.
F. Condition existing and new, masonry surfaces (solid backing) specified to receive plaster by applying metal plastering base as specified in ASTM C842.

3.3 INSTALLING PLASTERING ACCESSORIES

A. Install accessories in accordance with ASTM C841, except as follows:
   1. Set plastering accessories plumb, level and true to line, mitered at corners and intersections, and securely attach to supporting surfaces.
   2. Install in one piece, within the limits of the longest commercially available lengths.
   3. Wood plugs are not acceptable anchorage for fasteners.
B. Corner Beads: Install at external plaster corners.
C. Strip Lath:
   1. Install centered over joints between dissimilar materials, such as clay tile, brick, concrete masonry units, concrete, and expanded metal and gypsum lath. Install where surfaces are required to be plastered and are in contact with each other in same plane, except where expansion joints and casing beads are required.
   2. Wire tie, staple, screw, or nail strip lath to base along both edges at not over 152 mm (6 inches) on centers.
   3. Reinforce gypsum lath at corners of openings, at internal corners, and at chases and similar breaks in continuity in accordance with ASTM C841.
D. Casing Beads:
   1. Provide at locations where plaster terminates against other materials.
   2. Provide where indicated in construction documents.

3. Provide where plaster terminates against trim of steel frames and trim of other materials and equipment, except where trim overlaps plaster.
4. Provide where plaster for new walls or furring (vertical or horizontal) terminates against existing construction.
5. Provide around perimeter of openings for recessed casework and equipment, except where edge is covered by flanges. Locate to conform to dimensions shown on approved shop drawings.
6. Both sides of expansion and control joints, unless shown otherwise.
7. Where ceilings butt into or are penetrated by walls, columns, beams, and similar elements so as to provide floating angle (unrestrained) construction in accordance with ASTM C841.

E. Cornerites:
1. Provide at interior corners of walls, partitions, and other vertical surfaces to be plastered, except where lath is carried around angle.
2. Fasten only as necessary to retain position during plastering.
3. Omit cornerites at junction of new plastered walls with existing plastered walls.
4. Provide where metal plastering bases are specified not to be carried around internal angles, and at locations where casing beads are specified and shown.

F. Control Joints:
1. Where control joints are placed parallel to framing members, install joints within 101 mm (4 inches) of framing member.
2. Install control joints only to the edges of abutting sheets of lath so that the lath is not continuous or tied across joint.
3. Extend control joints the full width and height of the wall or length of soffit/ceiling plaster membrane.

3.4 GYPSUM PLASTER APPLICATION

A. Proportion, mix, and apply plaster in accordance with ASTM C842.

B. Thickness of Plaster: ASTM C842, except as follows:
1. Where greater thickness is indicated on construction documents.
2. Where thickness is required to match existing.
3. On metal plaster base 19 mm (3/4 inch), except where greater thickness is required for fire rated construction.
4. Apply finish coats to a uniform thickness of approximately 2 mm (1/16 inch) with not more than 3 mm (1/8 inch) thickness at any point.

C. Cut 2 mm (1/16 inch) deep V-joint in finish coat of plaster adjacent to metal door frames and wherever plaster finishes flush with other materials, except where casing beads are required. Omit 2 mm (1/16 inch) deep V-joint on walls and partitions where plaster is recessed back from face of door frames, or similar conditions.

D. Plaster to have a smooth-trowel finish unless specified or shown otherwise.

E. Apply gypsum plaster in three (3) coats.

F. Gypsum Plaster Base Coat: Apply base coats with sufficient pressure and ensure plaster is sufficiently plastic to provide a strong bond to bases. Work base coats into screeds at intervals from 1524 to 2438 mm (5 to 8 feet). Plaster must not be continuous across expansion and control joints occurring in walls, partitions, and ceilings. Finish work level, plumb, square, and true, within a tolerance of 3 mm in 2438 mm (1/8 inch in 8 feet) without waves, cracks, blisters, pits, crazing, discoloration, projections, or other imperfections. Form plaster work carefully around angles and contours, and well up to screeds. Take special care to prevent sagging and consequent dropping of applications. There must be no visible junction marks in finish coat where one day's work adjoins another.

   1. Gypsum Three-Coat Base Coat: Apply scratch coat 5 to 6 mm (3/16 to 1/4 inch) thick to cover the base with sufficient material and pressure to form a good bond on the wall or ceiling base. Rake or scratch the surface and allow to set firm and hard. Apply the brown coat to bring the base coat out to the screeds, compact, and straighten to a true surface without the application of water, and cross rake or scratch to receive the finish coat.

G. Gypsum Plaster Finish Coats: Moderately moisten or fog spray base coat of plaster that has become dry before finish coat is applied. Accelerate plaster, if necessary, to provide a setting time of not more than four (4) hours from the time the plaster is mixed.

   1. Lime-Putty and Gypsum Gauged Finish Coat: Apply lime-putty gypsum finish white coat over the base coat, scratch in thoroughly, lay on well, double back, and fill out to a true, even surface. Allow the finish to dry not more than five (5) minutes, then trowel well with water. Apply maximum pressure in order to compact the finish coat and provide a smooth finish free from blemishes and irregularities. Apply trowel finish coats of gypsum-gauged lime-putty over properly prepared base coats as thin as possible and 2 to 3 mm (1/16 to 1/8 inch) thick for conventional plaster system, except as necessary in spots to level out hollows in base coat.

H. Concealed Plaster:

   1. Where plaster is concealed behind built in cabinets, furnishings, or equipment, apply finish coat.
   2. Where plaster is concealed above ceilings, omit finish coat.
   3. Where plaster is used as a base for adhesive application of tile and similar finishes, omit finish coat.

3.5 PATCHING

A. After all work except painting is finished, point around trim, frames, and similar items.

B. Patch damaged plaster to match previously applied plaster in color and texture.

C. Sanding plaster is prohibited.

D. Patch, alter and replace existing plaster surfaces as required to complete work.

3.6 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work after plastering is complete. Remove droppings or spatterings from other surfaces not indicated to be plastered. Leave clean and in a condition to receive paint or other finish.

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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.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.

C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

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

B. Manufacturer's Literature and Data:
   1. Cornerbead and edge trim.
   2. Finishing materials.
   3. Laminating adhesive.
   4. Gypsum board, each type.

C. Shop Drawings:
   1. Typical gypsum board installation, showing corner details, edge trim details and the like.
   2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
   3. Typical shaft wall assembly.
   4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.

D. Samples:
   1. Cornerbead.
   2. Edge trim.
   3. Control joints.

E. Test Results:

1. Fire rating test, each fire rating required for each assembly.
2. Sound rating test.

F. Certificates: Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos material.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing And Materials (ASTM):

C11-15.....Terminology Relating to Gypsum and Related Building Materials and Systems
C475-15 .....Joint Compound and Joint Tape for Finishing Gypsum Board
C840-13 .....Application and Finishing of Gypsum Board
C919-12 .....Sealants in Acoustical Applications
C954-15 .....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
C1002-14 .....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
C1047-14 .....Accessories for Gypsum Wallboard and Gypsum Veneer Base
C1177-13 .....Glass Mat Gypsum Substrate for Use as Sheathing
C1178/C1178M-18.....Specification for Coated Glass Mat Water Resistant Backing Panel
C1658-13 .....Glass Mat Gypsum Panels
C1396-14 .....Gypsum Board

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.

C. Water Resistant Gypsum Backing Board: ASTM C1178, 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.
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. 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.

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.

3.5 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all 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 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 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 or fire protection equivalent to the fire rated construction.

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SECTION 09 30 13
CERAMIC/PORCELAIN TILING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies interior ceramic, porcelain tile, waterproofing membranes for thin-set applications, crack isolation membranes, and tile backer board.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS: Sealing of Joints.

B. Section 09 23 00, GYPSUM PLASTERING: Metal and Gypsum Lathing and Gypsum Plaster: Lathing and Portland.

C. Section 09 65 19, RESILIENT TILE FLOORING: Metal and Resilient Edge Strips at Joints with New Resilient Flooring.

1.3 SUBMITTALS

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

B. Samples:

1. Base tile, each type, each color, each size.
2. Mosaic floor tile panels, 228 by 228 mm (9 by 9 inches), each type, color, size and pattern.
3. Porcelain tile, each type, color, patterns and size.
4. Wall (or wainscot) tile, each color, size and pattern.
5. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.

C. Product Data:

1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
2. Chemical resistant mortar and grout (epoxy and furan).
3. Cementitious backer unit.
4. Dry-set portland cement mortar and grout.
5. Divider strip.
6. Elastomeric membrane and bond coat.
7. Reinforcing tape.
8. Leveling compound.
9. Latex-portland cement mortar and grout.
10. Commercial portland cement grout.
11. Slip resistant tile.
12. Waterproofing isolation membrane.
13. Fasteners.

D. Certification:

1. Master grade certificate, ANSI A137.1.
2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
   a. Chemical resistant mortar and grout (epoxy and furan).
   b. Modified epoxy emulsion.
   c. Commercial portland cement grout.
   d. Cementitious backer unit.
   e. Dry-set portland cement mortar and grout.
   f. Elastomeric membrane and bond coat.
   g. Reinforcing tape.
   h. Latex-portland cement mortar and grout.
   i. Leveling compound.
   j. Organic adhesive.
   k. Waterproof isolation membrane.
   l. Factory back mounted tile documentation for suitability for application in wet area.

E. Installer Qualifications:
   1. Submit letter stating installer’s experience.

1.4 DELIVERY AND STORAGE

A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.

B. Store material to prevent damage or contamination.

1.5 QUALITY ASSURANCE

A. Installers to be from a company specializing in performing installation of products specified and have a minimum of three (3) years’ experience.

B. Each type and color of tile to be provided from a single source.

C. Each type and color of mortar, adhesive, and grout to be provided from the same source.

1.6 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21, “Warranty of Construction”.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.

B. American National Standards Institute (ANSI):

A10.20-06(R2016).....Safe Operating Practices for Tile, Terrazzo and Marble Work

A108/A118/A136.1:2019.....Installation of Ceramic Tile

A108.01-18.....Subsurfaces and Preparations by Other Trades

A108.02-19.....Materials, Environmental, and Workmanship

A108.1A-17 .....Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar

A108.1B-17 ..... Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar

A108.1C-17 ..... Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar

A108.4-09..... Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive

A108.5-10 ..... Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar

A108.6-10..... Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy

A108.8-10..... Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout

A108.9-10..... Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout

A108.10-17..... Grout in Tilework

A108.11-18..... Interior Installation of Cementitious Backer Units

A108.12-10..... Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar

A108.13-16..... Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone

A108.14-10..... Paper-Faced Glass Mosaic Tile

A108.15-19..... Alternate Method: Paper-Faced Glass Mosaic Tile

A108.17-16..... Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone

A118.1-19..... Dry-Set Portland Cement Mortar

A118.3-13..... Chemical Resistant, Water Cleanable Tile-Setting and –Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive

A118.4-19..... Modified Dry-Set Cement Mortar

A118.5-16..... Chemical Resistant Furan Mortars and Grouts

A118.6-19..... Standard Cement Grouts for Tile Installation

A118.7-1..... High Performance Cement Grouts for Tile Installation

A118.8-16..... Modified Epoxy Emulsion Mortar/ Grout

A118.9-19..... Cementitious Backer Units

A118.10-14..... Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation

A118.11-17..... EGP (Exterior Glue Plywood) Modified Dry-set Mortar

A118.12-14.....Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation

A118.13-14.....Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation

A118.15-19.....Improved Modified Dry-Set Cement Mortar

A136.1-13.....Organic Adhesives for Installation of Ceramic Tile

A137.1-17.....American National Standard Specifications for Ceramic Tile

C. ASTM International (ASTM):

A666-15.....Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

A1064/A1064M-18a .....Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C109/C109M-20b.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)

C241/C241M-15e1.....Abrasion Resistance of Stone Subjected to Foot Traffic

C348-20 .....Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars

C627-18 .....Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester

C954-18 .....Steel Drill Screws for the Application of Gypsum Board on Metal Plaster Base to Steel Studs from 0.033 in (0.84 mm) to 0.112 in (2.84 mm) in thickness

C979/C979M-16.....Pigments for Integrally Colored Concrete

C1002-18 .....Steel Self-Piercing Tapping Screws for the Application of Panel Products

C1027-19 .....Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile

C1127/C1127M-15.....Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface

C1178/C1178M-18.....Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel

C1325-19 .....Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units

C1353/C1353M-20e1.....Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform, Double-Head Abraser

D1204-14(2020).....Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

D2240-15e1 .....Test Method for Rubber Property – Durometer Hardness

D2497-07(2018).....Tolerances for Manufactured Organic-Base Filament Single Yarns

D3045-2018 .....Heat Aging of Plastics Without Load

D4397-16 .....Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

D5109-12(Withdrawn2020).....Standard Test Methods for Copper-Clad Thermosetting Laminates for Printed Wiring Boards (recommend deletion)

D. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

E. Marble Institute of America (MIA)/ Building Stone Institute (BSI): Dimension Stone Design Manual VIII-2016

F. Tile Council of North America, Inc. (TCNA):

Handbook for Ceramic Tile Installation (2020)G. TCNA DCOF AcuTest-2012,Dynamic Coefficient of Friction Test

PART 2 - PRODUCTS

2.1 TILE

A. Comply with ANSI A137.1, Standard Grade, except as modified:

1. Inspection procedures listed under the Appendix of ANSI A137.1.
2. Abrasion Resistance Classification:
   a. Tested in accordance with values listed in Table 1, ASTM C1027.
   b. Class V, 12000 revolutions for floors in Corridors, Kitchens, Storage including Refrigerated Rooms
   c. Class IV, 6000 revolutions for remaining areas.
3. Slip Resistant Tile for Floors:
   a. Coefficient of friction, when tested in accordance with ANSI A137.1 and measured per the TCNA DCOF AcuTest.
      1) Equal to or greater than .42 for level interior tile floors that will be walked on when wet.
   b. Tile Having Abrasive Grains:
      1) Unglazed Ceramic Mosaic Tile: Abrasive grains throughout body of the tile.
4. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one (1) package show the same range in colors as those taken from other packages and match approved samples.
5. Factory-Applied Temporary Protective Coating:

a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of hot applied petroleum paraffin wax.

b. Do not coat unexposed tile surfaces.

2.2 BACKER UNITS

A. Cementitious Backer Units:

1. Use in showers or wet areas.
2. Conform to ASTM C1325; Type A.
3. Use in maximum lengths available to minimize end to end butt joints.

2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS

A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.

B. Tape Embedding Material: Latex-portland cement mortar complying with ANSI A108.01.

C. Joint material, including reinforcing tape, and tape embedding material, are to be as specifically recommended by the backer unit manufacturer.

2.4 FASTENERS

A. Screws for Cementitious Backer Units.

1. Standard screws for gypsum board are not acceptable.
2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
3. ASTM C954 for steel 1 mm (0.033 inch) thick.
4. ASTM C1002 for steel framing less than 0.0329 inch thick.

B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

2.5 SETTING MATERIALS OR BOND COATS

A. Conform to TCNA Handbook for Ceramic Tile Installation.

B. Portland Cement Mortar: ANSI A108.02.

C. Latex-Portland Cement Mortar: ANSI A118.4.

1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.4.
2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.

D. Dry-Set Portland Cement Mortar: ANSI A118.1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.1.

E. Elastomeric Waterproofing Membrane and Bond Coat:

1. TCNA F122-14 (on ground concrete) and TCNA F112A-14 (above ground concrete).
2. ANSI A118.10.
3. One component polyurethane, liquid applied material having the following additional physical properties:

a. Hardness: Shore "A" between 40-60.
b. Elongation: Between 300-600 percent.
c. Tensile strength: Between .27 - .41 Newton per square millimeter (40-60 pounds per square inch gauge).

4. Coal tar modified urethanes are not acceptable.

F. Waterproofing Isolation Membrane:

1. Sheet System TCNA F122-14 (on-ground concrete) and TCNA F122A-14 (above-ground concrete).
2. Composite sheet consisting of ASTM D5109, Type II, Grade I Chlorinated Polyethylene (CM) sheet reinforced on both sides with a non-woven polyester fiber.
3. Designed for use in wet areas as an isolation and positive waterproofing membranes for thin-set bonding of sheet to substrate and thin-set bonding of ceramic and porcelain tile or marble to sheet. Suited for both horizontal and vertical applications.
4. Conform to the following additional physical properties:

Property	Units	Results	Test Method
Hardness Shore A	Points	70-80	ASTM D2240 (10 Second Reading)
Shrinkage	Percent	5 maximum	ASTM D1204
Brittleness		No crack remains flexible at temperature -37 degrees C (-35 degrees F)	ASTM D2497 13 mm (1/2-inch) Mandrel Bend
Retention of Properties after Heat Aging	Percent of original	80 Tensile 80 Breaking 80 Elongation	ASTM D3045, 90 degrees C (194 degrees F) for 168 hours

5. Manufacturer’s standard sheet size with prefabricated or preformed inside and outside corners.
6. Sheet manufacturer’s solvent welding liquid or xylene and edge sealant.

2.6 GROUTING MATERIALS

A. Coloring Pigments:

1. Pure mineral pigments, lime proof and nonfading, complying with ASTM C979/C979M.
2. Coloring pigments may only be added to grout by the manufacturer.
3. Job colored grout is not acceptable.
4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.

B. High Performance Tile Grout: ANSI A118.7with a VOC content of 65 g/L or less when calculated according to 40 CFR 59 (EPA Method 24).
   1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
   2. Polymer Type: Acrylic resinor styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

2.7 PATCHING AND LEVELING COMPOUND

A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
B. Provide a patching and leveling compound with the following minimum physical properties:
   1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
   2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
   3. Tensile strength – 4.1 MPa (600 psi) per ANSI 118.7.
   4. Density – 1.9.
C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 101 mm (4 inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.
D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.
E. Ready for use in 48 hours after application.

2.8 METAL DIVIDER STRIPS

A. Heavy top type strip with 5 mm (3/16 inch) wide top and 38 mm (1 1/2 inch) long leg. Height to match tile and setting-bed thickness.
B. Embedded leg perforated and deformed for keying to mortar.
C. stainless-steel, exposed-edge material.

2.9 WATER

A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

2.10 CLEANING COMPOUNDS

A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
B. Materials containing acid or caustic Material are not acceptable.

2.11 POLYETHYLENE SHEET

A. Polyethylene sheet conforming to ASTM D4397.
B. Nominal thickness: 0.15 mm (6 mils).

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature of work areas at not less than 16 degrees C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three (3) days after installation.

B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.

C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).

D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).

E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after third day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:

1. Not more than 6 mm in 3048 mm (1/4 inch in 10 feet) from required elevation where portland cement mortar setting bed is used.
2. Not more than 3 mm in 3048 mm (1/8 inch in 10 feet) where dry-set portland cement, and latex-portland cement mortar setting beds and chemical-resistant bond coats are used.

B. Variation in Plane of Wall Surfaces:

1. Not more than 6 mm in 2438 mm (1/4 inch in 8 feet) from required plane where portland cement mortar setting bed is used.
2. Not more than 3 mm in 2438 mm (1/8 inch in 8 feet) where dry-set or latex-portland cement mortar or organic adhesive setting materials is used.

3.3 SURFACE PREPARATION

A. Cleaning Masonry:

1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning masonry.
2. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.

B. Patching and Leveling:

1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
2. Fill holes and cracks and align floors that are out of required plane with patching and leveling compound.
   a. Thickness of compound as required to bring finish tile system to elevation shown on construction documents.
   b. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

3. Apply patching and leveling compound to masonry wall surfaces that are out of required plane.
4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than masonry that are out of required plane.

C. Mortar Bed for Slopes to Drains:
1. Slope compound to drain where drains are shown on construction documents.
2. Install mortar bed in depressed slab sloped to drains not less than 3.2 mm in 305 mm (1/8 inch per foot).
3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.
4. Screed for slope to drain and float finish.
5. Cure mortar bed for not less than seven (7) days. Do not use curing compounds or coatings.
6. Perform flood test to verify mortar bed slopes to drain before installing tile. Contracting Officer Representative (COR) to be present during flood test.

D. Walls:
1. In wet areas cover studs with polyethylene sheet.
2. Apply patching and leveling compound to masonry surfaces that are out of required plane.
3. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than masonry that are out of required plane.

E. Existing Floors and Walls:
1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.
2. Where new tile bases are required to finish flush with plaster above or where they are extensions of similar bases in conjunction with existing floor tiles, cut channel in floor slab and expose rough wall construction sufficiently to accommodate new tile base and setting material.

3.4 CEMENTITIOUS BACKER UNITS

A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.

B. Install in accordance with ANSI A118.9 except as specified otherwise.

C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a “V” joint for joint treatment.

D. Secure cementitious backer units to each framing member with screws spaced not more than 203 mm (8 inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or

as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.

E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.

F. Do not install joint treatment for seven (7) days after installation of cementitious backer unit.

G. Joint Treatment:

1. Fill horizontal and vertical joints and corners with latex-portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

3.5 CERAMIC TILE – GENERAL

A. Comply with ANSI A108/A118/A136 series of tile installation standards applicable to methods of installation and TCNA Installation Guidelines.

B. Installing Mortar Beds for Floors:

1. Install mortar bed in a manner that does not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.
2. Install floor mortar bed reinforcing centered in mortar fill.
3. Screed finish to level plane or slope to drains shown on construction documents, float finish.
4. For thin set systems cure mortar bed not less than seven (7) days. Do not use curing compounds or coatings.
5. For tile set with portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.

C. Setting Beds or Bond Coats:

1. Use quarry tile in chemical-resistant bond coat.
   a. Portland cement paste over plastic mortar bed. ANSI A108.1A.
   b. Dry-set portland cement mortar over cured mortar bed. ANSI A108.1B.
2. Set floor tile in elastomeric bond coat over elastomeric membrane per ANSI 108.13, TCNA System F122-14 where indicated on construction documents.
3. Set wall tile installed over masonry in dry-set portland cement mortar, or latex-portland cement mortar, ANSI 108.1B and TCNA System W211-14, W221-14 or W222-14.
4. Set wall tile installed over concrete backer board in latex-portland cement mortar, ANSI A108.1B.
5. Set wall tile installed over portland cement mortar bed on metal lath base in portland cement paste over plastic mortar bed, or dry-set portland cement mortar or latex-portland cement mortar over a cured mortar bed, ANSI A108.1C, TCNA System W231-14, W241-14.
6. Set trim shapes in same material specified for setting adjoining tile.

D. Workmanship:

1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field.
2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise on construction documents.
3. Form intersections and returns accurately.
4. Cut and drill tile neatly without marring surface.
5. Cut edges of tile abutting penetrations, finish, or built-in items:
   a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
   b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
6. Completed work is to be free from hollow sounding areas and loose, cracked or defective tile.
7. Remove and reset tiles that are out of plane or misaligned.
8. Floors:
   a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
   b. Align finish surface of new tile work flush with other and existing adjoining floor finish where indicated in construction documents.
   c. In areas where floor drains occur, slope tile to drains.
   d. Push and vibrate tiles over 203 mm (8 inches) square to achieve full support of bond coat.
9. Walls:
   a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights as indicated in construction documents with tile.
   b. Finish reveals of openings with tile, except where other finish materials are indicated in construction documents.
   c. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
10. Joints:
    a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise on construction documents.
    b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
    c. Make joints in quarry tile work not less than 6 mm (1/4 inch) nor more than 9 mm (3/8 inch) wide. Finish joints flush with surface of tile.
    d. Make joints in paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.

11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108/A118/A136 series of tile installation standards:
    a. Tile wall installations in wet areas.

3.6 GROUTING

A. Workmanship:
   1. Install and cure grout in accordance with the applicable standard.
   2. Epoxy Grout: ANSI A108.6.

3.7 MOVEMENT JOINTS

A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.
B. TCNA details EJ 171-14.
C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.

3.8 CLEANING:

A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
B. Methods and materials used are not permitted to damage or impair appearance of tile surfaces.
C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
D. Clean tile grouted with epoxy, furan and commercial portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

3.9 PROTECTION

A. Keep traffic off tile floor, until grout and setting material is fully set and cured.
B. Where traffic occurs over tile floor is unavoidable, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

3.10 TESTING FINISH FLOOR

A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

- - - E N D - - -

SECTION 096400
WOOD FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies installation and finishing of wood flooring.

1.2 RELATED WORK

A. Section 06 10 00, ROUGH CARPENTRY

B. Section 06 20 00, FINISHES CARPENTRY

C. Section 09 06 00, SCHEDULE OF FINISHES

1.3 APPLICABLE PUBLICATIONS

A. Hardwood Plywood and Veneer Association (HPVA):
HP1-16……. Hardwood and Decorative Plywood.

B. Federal Specifications (Fed. Spec.):
MM-L-736C (1) …… Lumber, Hardwood

1.4 SUBMITTALS

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

B. Product Data: For each type of product.

C. Shop Drawings: For each type of floor assembly and accessory. Include plans, sections, and attachment details. Include expansion provisions and trim details.

D. Samples: For each exposed product and for each color and texture specified, approximately 12 inches and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

E. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and finishes available for wood flooring.

1. Include Samples of accessories involving color and finish selection.

F. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wood Flooring: Equal to 1 percent of amount installed for each type, color, and finish of wood flooring indicated.

1.6 MOCKUP:

A. Provide 24” x 24” mockup with custom wood finish to match existing stain before production.

B. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications
   1. Regularly fabricates specified products
   2. Fabricated specified products with satisfactory service on five similar installations for minimum five years
      a. Project Experience List: Provide contact names and addresses for completed projects

B. Installer Qualifications
   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.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood flooring materials in unopened cartons or bundles.

B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet-work is complete and dry.

C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.9 FIELD CONDITIONS

A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
   1. Environmental Conditioning: Maintain ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
   2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
      a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.

b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction”.

PART 2 - PRODUCTS

2.1 GENERAL

A. See Section 09 06 00, SCHEDULE OF FINISHES.

B. Size and species to match existing: Plainsawn white oak, 4”W x 47”L planks.

2.2 PERFORMANCE REQUIREMENTS

A. Hardwood Flooring: Comply with NWFA A500 for species, grade, and cut.

1. Certification: Provide flooring that carries NWFA grade stamp on each bundle or piece.
2. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

2.3 ACCESSORY MATERIALS

A. Wood Sleepers and Subfloor: As specified in Section 06 10 00 "Rough Carpentry"

B. Vapor Retarder: ASTM D4397, polyethylene sheet not less than 8.0 mils (0.2 mm) thick.

C. Wood Flooring Adhesive: Mastic recommended by flooring and adhesive manufacturers for application indicated.

D. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.

E. Fasteners: As recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines."

F. Thresholds and Saddles: To match wood flooring. Tapered on each side.

G. Reducer Strips: To match wood flooring. 2 inches wide, tapered, and in thickness required to match height of flooring.

H. Feature Strips: 4-inch- (102-mm-) wide, square-edged oak strips, furnished in lengths as long as practical and in thickness to match wood flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines."

B. Wood Sleepers and Subfloor: Install according to requirements in Section 06 10 00 ROUGH CARPENTRY.

C. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 1/2 inch (12 mm).

D. Vapor Retarder: Comply with the following for vapor retarder installation:

1. Wood Flooring Nailed to Wood Subfloor: Install flooring over a layer of asphalt-saturated felt.

E. Sound Control Underlayment: Install over vapor retarder according to manufacturer's written instructions.

F. Solid-Wood Flooring: Blind nail or staple flooring to substrate.

1. Plank Flooring: For flooring of face width more than 3 inches (76 mm):

a. Hardwood: Install countersunk screws at each end of each piece in addition to blind nailing. Cover screw heads with wood plugs glued flush with flooring.

3.4 FIELD FINISHING

A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that are noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.

1. Comply with applicable recommendations in NWFA's "Installation Guidelines."

B. Fill plainsawn white oak planks.

C. Fill and repair wood flooring defects.

D. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.

1. Apply stains to achieve an even color distribution matching approved Samples.

2. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.

E. Cover wood flooring before finishing.

F. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

3.5 PROTECTION

A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.

1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

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SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient stair treads (RST) adhered to interior stair treads.

APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

F1344-15 ..... Rubber Floor Tile.

F1861-16 ..... Resilient Wall Base.

1.2 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Adhesives and primers indicating manufacturer's recommendation for each application.
3. Installation instructions.

C. Samples:

1. Resilient Base: 150 mm (6 inches) long, each type and color.
2. Resilient Stair Treads: 150 mm (6 inches) long, each type and color.

D. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.

1.3 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.

1.4 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage when handling and during construction operations.

1.5 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.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Basis of Design: Refer to finish legend in construction drawings.
B. Provide each product from one manufacturer and from one production run.
C. Provide resilient stair treads and accessories from same manufacturer.

2.2 RESILIENT STAIR TREADS

A. Resilient Stair Treads: Rubber, skid-resistant abrasive strip nosing, 5 mm (3/16 inch) thick nosing wear surface tapered to 3 mm (1/8 inch) thick at riser.
   1. Fed. Spec. RR-T-650, Composition A, Type 2.
   2. Nosing: Flexible, accommodating angle between tread and riser; shape suiting sub-tread.
   3. Size: Single piece full stair tread width and depth.

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 stair treads landing flooring to permit new installation.
   1. Dispose of removed materials.
D. Correct substrate deficiencies on existing hardwood stairs, limited to the area under new resilient treads.
   1. Fill cracks, pits, and depressions with leveling compound, compatible with hardwood.
   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. 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 STAIR TREAD INSTALLATION

A. Install resilient stair treads without joints on each stair tread substrate.
   1. Install full width resilient stair treads on each intermediate and floor landing.
B. Apply adhesive uniformly for full contact between resilient stair tread and substrate.
   1. Roll resilient stair treads ensuring complete adhesion.

3.4 CLEANING

A. Remove excess adhesive before adhesive sets.
B. Clean exposed resilient stair treads surfaces. Remove contaminants and stains.
   1. Clean with mild detergent. Leave surfaces free of detergent residue.

3.5 PROTECTION

A. Prohibit traffic on resilient stair treads 72 hours, minimum, after installation.
B. Protect products from construction traffic and operations.
   1. Cover resilient stair treads with reinforced kraft paper, and plywood or hardboard.
   2. Maintain protection until directed by Contracting Officer's Representative.
C. Replace damaged products and re-clean.
   1. Damaged Products include cut, gouged, scraped, torn, and unbonded products.

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SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies the installation of linoleum tile 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: Refer to finish legend in construction documents.

1.3 SUBMITTALS:

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

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Resilient material manufacturer’s recommendations for adhesives, underlayment, primers, and polish.
3. Application, installation and maintenance instructions.

C. Samples:

1. Tile: Each type, color, thickness and finish.
2. Edge Strips: Each type, color, thickness and finish.
3. Feature Strips: Each type, color, thickness and finish.

D. Shop Drawings:

1. Layout of patterns as shown on the construction documents.
2. Edge strip locations showing types and detail cross sections.

E. Test Reports:

1. Abrasion resistance: Depth of wear for each tile type and color and volume loss of tile, certified by independent laboratory. Tested per ASTM F510/F510M.
2. Moisture and pH test results as per Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

1.4 DELIVERY:

A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.

B. Materials from containers which have been distorted, damaged or opened prior to installation are not acceptable.

1.5 STORAGE:

A. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives, and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.6 QUALITY ASSURANCE:

A. Installer Qualifications: A company specializing in installation with minimum three (3) years' experience and employs experienced flooring installers who have retained, and currently hold, an INSTALL Certification, or a certification from a comparable certification program.

1. Installers to be certified by INSTALL or a comparable certification program with the following minimum criteria:

a. US Department of Labor approved four (4) year apprenticeship program, 160 hours a year.

b. Career long training.

c. Manufacturer endorsed training.

d. Fundamental journeyman skills certification.

B. Mockup: Build floor tile mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Size: 9.3 sq. m (100 sq. ft.) for each type, color, and pattern. Locations as indicated on construction documents.

2. Contracting Officer Representative (COR) approved mockup may become part of the completed Project if undisturbed at time of Substantial Completion.

C. Furnish product type materials from the same production run.

1.7 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

1.8 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

D2047-11 ..... Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine

D2240-05(R2010) ..... Test Method for Rubber Property—Durometer Hardness

D4078-02(R2008) ..... Water Emulsion Floor Finish

E648-14c ..... Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source

E662-14.....Specific Optical Density of Smoke Generated by Solid Materials
E1155/E1155M-14 .....Determining Floor Flatness and Floor Levelness Numbers
F510/F510M-14.....Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method
F925-13.....Test Method for Resistance to Chemicals of Resilient Flooring
F1344-12(R2013).....Rubber Floor Tile
F1700-13a.....Solid Vinyl Floor Tile
F1869-11.....Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
F2195-13.....Linoleum Floor Tile

C. Code of Federal Regulation (CFR):
40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

D. International Standards and Training Alliance (INSTALL):

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS:

A. Provide adhesives, underlayment, primers, and polish recommended by resilient floor material manufacturer.
B. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
C. Smoke Density: Less than 450 per ASTM E662.
D. Slip Resistance – Not less than 0.5 when tested with ASTM D2047.

2.3 LINOLEUM TILE:

A. ASTM F2195.
B. Tile to consist of a homogeneous layer of a mixture of linoleum cement (binder in linoleum consisting of a mixture of linseed oil, pine rosin, fossil, or other resins or rosins, or an equivalent oxidized oleoresinous binder), cork and/or wood flour, mineral fillers, and pigments bonded to a polyester backing.

2.6 ADHESIVES:

A. Provide water resistant type adhesive for flooring, base and accessories as recommended by the manufacturer to suit substrate conditions. VOC content to be less than the 50 grams/L when calculated according to 40 CFR 59 (EPA Method 24). Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics.

2.9 POLISH AND CLEANERS:

A. Cleaners: As recommended in writing by floor tile manufacturer.
B. Polish: ASTM D4078.

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.

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. Installation of Edge Strips:
   1. Locate edge strips under center line of doors unless otherwise shown on construction documents.
   2. Set resilient edge strips in adhesive. Anchor metal edge strips with anchors and screws.
   3. Where tile edge is exposed, butt edge strip to touch along tile edge.
   4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor file and against the ceramic tile edge.

3.4 CLEANING AND PROTECTION:

A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.
B. Keep traffic off resilient material for a minimum 72 hours after installation.
C. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions and within the recommended time frame. As required by the manufacturer, apply the recommended number of coats and type of polish and/or finish in accordance with manufacturer's written instructions.
D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by COR. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by COR.
E. When protective materials are removed and immediately prior to acceptance, replace damaged tile and mouldings, re-clean resilient materials.

3.5 LOCATION:

A. Unless otherwise indicated in construction documents, install tile flooring, under areas where casework, laboratory and pharmacy furniture and other equipment occur.
B. Extend tile flooring for room into adjacent closets and alcoves.

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SECTION 09 68 00
CARPETING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section specifies carpet, molding, adhesives, and other items required for complete installation.

1.2 RELATED WORK

A. Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES: Testing of Concrete Floors Before Installation.

B. Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A company specializing in carpet installation with a minimum three (3) years' experience and employing experienced flooring installers who have retained, and currently hold, an INSTALL Certification, or a certification from a comparable certification program, and a valid OSHA 10 certification.

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.

1.4 SUBMITTALS

A. Product Data:

1. Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics for each type of carpet material and installation accessory.
2. Manufacturer's printed installation instructions for the carpet, including preparation of installation substrate, seaming techniques and recommended adhesives and tapes.

B. Samples:

1. Carpet: "Production Quality" samples 305 x 305 mm (12 x 12 inches) of carpets, showing quality, pattern and color specified in Section 09 06 00, SCHEDULE FOR FINISHES.
2. Floor Edge Strip (Molding): 152 mm (6 inches) long of each color and type specified.
3. Base Edge Strip (Molding): 152 mm (6 inches) long of each color specified.

C. Shop Drawings: Installers layout plan showing seams and cuts for sheet carpet and carpet module.

D. Maintenance Data: Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

E. Installer's Qualifications.

F. Manufacturer's warranty.

1.5 DELIVERY AND STORAGE

A. Deliver carpet in manufacturer's original wrappings and packages clearly labeled with manufacturer's brand name, size, dye lot number and related information. Transport carpet to job site in a manner that prevents damage and distortion that might render it unusable. When bending or folding is unavoidable for delivery purposes, unfold carpet and lay flat immediately.

B. Deliver adhesives in containers clearly labeled with manufacturer's brand name, number, installation instructions, safety instructions and flash points.

C. Store in a clean, dry, well-ventilated area, protected from damage and soiling. Before installation, acclimate carpet to the atmospheric conditions of the areas in which it will be installed for 2 days 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 carpet for a minimum of ten (10) 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. American National Standards Institute (ANSI):

ANSI/NSF 140-10 .....Sustainable Carpet Assessment Standard

C. American Association of Textile Chemists and Colorists (AATCC):

16-04 .....Colorfastness to Light

134-11 .....Electric Static Propensity of Carpets

165-08 .....Colorfastness to Crocking: Textile Floor Coverings-AATCC Crockmeter Method

174-11 .....Antimicrobial Activity Assessment of New Carpets

D. ASTM International (ASTM):

D3278-20 .....Flash Point of Liquids by Small Scale Closed-Cup Apparatus

D5116-17 .....Determinations of Organic Emissions from Indoor Materials/Products

D5252-20 .....Operation of the Hexapod Tumble Drum Tester

D5417-16 .....Operation of the Vettermann Drum Tester

E648-19ae1.....Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

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. The Carpet and Rug Institute (CRI):

CIS ..... Carpet Installation Standard

G. International Standards and Training Alliance (INSTALL)

H. International Organization for Standardization (ISO):

2551-81 ..... Machine-Made Textile Floor Coverings

I. U.S. Consumer Product and Safety Commission (CPSC):

16 CFR 1630 ..... Surface Flammability of Carpets and Rugs

PART 2 - PRODUCTS

2.1 CARPET

A. Physical Characteristics:

1. Carpet free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains and other physical and manufacturing defects.
2. Type:
   a. Carpet Construction: Tufted
   b. Carpet Type: Modular tile.
   c. Pile Type: Cut pile.
   d. Pile Fiber: Commercial 100 percent branded (federally registered trademark), nylon continuous filament.
3. Backing Materials: Provide backing for release adhesive for modular tile installations.
   a. Modular Tile:
      1) Primary Backing/Backcoating: Manufacturer's standard composite materials
4. Appearance Retention Rating (ARR): Carpet to be tested and have the minimum 3.5 – 4.0 severe ARR when tested in accordance with either the ASTM D5252 (Hexapod) or ASTM D5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified in the ASTM standard.
5. Colorfastness to Crocking: Dry and wet crocking and water bleed, comply with AATCC 165 Color Transference Chart for colors, minimum class 4 rating.
6. Colorfastness to Light (AATCC 16, Option 3): Color change between the exposed and unexposed carpet areas equivalent to a minimum of Grade 4 on the Gray Scale for Color Change after an exposure of 40 AFU (AATCC fading units) for all specified colors.
7. Delamination Strength: Minimum of 440 N/m (2.5 lb./inch) between secondary backing.
8. Flammability and Critical Radiant Flux Requirements:
   a. Comply with 16 CFR 1630.
9. Average Pile Yarn Density (APYD):

a. Corridors, lobbies, entrances, common areas or multipurpose rooms, open offices, waiting areas and dining areas: Minimum APYD 6000.
b. Other areas: Minimum APYD 4000.

2.2 ADHESIVE AND CONCRETE PRIMER

A. Provide water resistant, mildew resistant, nonflammable, and nonstaining adhesives and concrete primers for carpet installation. Provide release adhesive for modular tile carpet as recommended by the carpet manufacturer. Provide adhesives flashpoint of minimum 60 degrees C (140 degrees F) in accordance with ASTM D3278.

2.3 EDGE STRIPS (MOLDING)

A. Metal:
1. Utilize metal in corridors and where subject to crat traffic.
2. Hammered surface aluminum, pinless, clamp down type designed for the carpet being installed.
3. Floor flange not less than 38 mm (1-1/2 inches) wide, face not less than 16 mm (5/8 inch) wide.
4. Finish: Clear anodized.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Contractor to prepare and test surfaces to receive carpet and adhesives as per Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

3.2 GENERAL INSTALLATION

A. Isolate area of installation from rest of building.
B. Perform all work by manufacturer’s approved installers. Conduct installation in accordance with the manufacturer’s printed instructions and CRI CIS.
C. Protect edges of carpet meeting hard surface flooring with molding and install in accordance with the molding manufacturer’s printed instructions.
D. Follow ventilation, personal protection, and other safety precautions recommended by the adhesive manufacturer. Continue ventilation during installation and for at least three (3) days following installation.
E. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation.
F. Complete other work which would damage the carpet prior to installation of carpet.
G. Follow carpet manufacturer's recommendations for matching pattern and texture directions.
H. Cut openings in carpet where required for installing equipment, pipes, outlets, and penetrations. Bind or seal cut edge of sheet carpet. Use additional adhesive to secure carpets around pipes and other vertical projections.

3.3 MODULAR TILE INSTALLATION

A. Install per CRI CIS, Adhesive Application.

B. Lay carpet modules with pile in same direction unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.

C. Install carpet modules so that cleaning methods and solutions do not cause dislocation of modules.

D. Lay carpet modules uniformly to provide tight flush joints free from movement when subject to traffic.

3.4 EDGE STRIPS INSTALLATION

A. Install edge strips over exposed carpet edges adjacent to uncarpeted finish flooring.

B. Anchor metal strips to floor with suitable fasteners. Apply adhesive to edge strips, insert carpet into lip and press it down over carpet.

3.5 PROTECTION AND CLEANING

A. Once a carpet installation is complete, clean up scrap materials and debris, and vacuum the area, using manufacturer-approved equipment. Inspect seams carefully for evenness and protruding backing yarns, and inspect the perimeter of the installation for an acceptable finished appearance.

B. Protect installed carpet if furniture is being moved, by laying plywood, fiberboard or porous non-staining sheeting material for minimum time practical. Based on manufacturer guidelines, protect carpet from rolling or foot traffic. Protect against other materials or renovation or construction activities, including dust, debris, paint, contractor traffic, until it is ready for its final use.

C. Do not move furniture or equipment on unprotected carpeted surfaces.

D. Just before final acceptance of work, remove protection and vacuum carpet clean.

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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 gypsum drywall exposed to view.
7. 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.
8. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
9. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
10. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
11. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
12. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.

1.2 RELATED WORK

A. Section 01 35 26, SAFETY REQUIREMENTS: Activity Hazard Analysis.

B. Section 01 81 13, SUSTAINABLE CONSTUCTION REQUIREMENTS: Sustainable Design Requirements.

C. Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL: Lead Paint Removal.

D. Division 05 METALS: Shop prime painting of steel and ferrous metals.

E. Division 08 OPENINGS: Shop prime painting of steel and ferrous metals.

F. Section 09 06 00, SCHEDULE FOR FINISHES: Type of Finish, Color, and Gloss Level of Finish Coat.

G. Division 10 SPECIALTIES: Shop prime painting of steel and ferrous metals.
H. Division 11 EQUIPMENT: Shop prime painting of steel and ferrous metals.
I. Division 12 FURNISHINGS: Shop prime painting of steel and ferrous metals.
J. Division 13 SPECIAL CONSTRUCTION: Shop prime painting of steel and ferrous metals.
K. Division 14 CONVEYING EQUIPMENT: Shop prime painting of steel and ferrous metals.
L. Division 21 FIRE SUPPRESSION: Shop prime painting of steel and ferrous metals.
M. Division 22 PLUMBING: Shop prime painting of steel and ferrous metals.
N. Division 23 HEATING; VENTILATION AND AIR-CONDITIONING: Shop prime painting of steel and ferrous metals.
O. Division 26 ELECTRICAL: Shop prime painting of steel and ferrous metals.
P. Division 27 COMMUNICATIONS: Shop prime painting of steel and ferrous metals.
Q. Division 28 ELECTRONIC SAFETY AND SECURITY: Shop prime painting of steel and ferrous metals.
R. Division 32 EXTERIOR IMPROVEMENTS: 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. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
   c. Product type and color.
   d. Name of project.
5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

F. Sample of identity markers if used.

G. Manufacturers' Certificates indicating compliance with specified requirements:
1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. High temperature aluminum paint.
3. Epoxy coating.
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 MOCK-UP PANEL

A. Provide paint sample on brick on exterior of building as shown in drawings.
   a. Provide a mockup of color specified in drawings for final selection. Color may adjusted to reflect field conditions. Provide up to 3 revisions of mockups base upon approval.

B. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 3.05 m (10 feet) wide, floor to ceiling of wall surfaces, before proceeding with the remainder of the work, for approval by the COR. Paint mock-ups to include one (1) door and frame assembly.

C. Finish and texture approved by COR will be used as a standard of quality and workmanship for remainder of work.

D. Repaint individual areas which are not approved, as determined by the COR, until approval is received.

1.7 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.

1.8 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.

1.9 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. American Conference of Governmental Industrial Hygienists (ACGIH):
   ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
   ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)

C. ASME International (ASME):
   A13.1-07(R2013).....Scheme for the Identification of Piping Systems

D. Code of Federal Regulation (CFR):
   40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

E. Commercial Item Description (CID):
   A-A-1272A.....Plaster Gypsum (Spackling Compound)

F. Federal Specifications (Fed Spec):
   TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):
   1 .....Aluminum Paint

3 .....Primer, Alkali Resistant, Water Based
4 .....Interior/ Exterior Latex Block Filler
5 .....Exterior Alkyd Wood Primer
6 .....Exterior, Latex for Exterior Wood Primer
7 .....Exterior Oil Wood Primer
8 .....Exterior Alkyd, Flat MPI Gloss Level 1
9 .....Exterior Alkyd Enamel MPI Gloss Level 6
10 .....Exterior Latex, Flat
11 .....Exterior Latex, Semi-Gloss
15 .....Exterior Latex, Low Sheen (MPI Gloss Level 3-4)
17 .....Primer, Bonding, Waterbased
18 .....Organic Zinc Rich Primer
22 .....Aluminum Paint, High Heat (up to 590% - 1100F)
23 .....Primer, Metal, Surface Tolerant
27 .....Exterior / Interior Alkyd Floor Enamel, Gloss
31 .....Polyurethane, Moisture Cured, Clear Gloss
36 .....Knot Sealer
39 .....Primer, Latex, for Interior Wood
40 .....Exterior, Latex High Build
42 .....Textured Coating, Latex, Flat
43 .....Interior Satin Latex, MPI Gloss Level 4
44 .....Interior Low Sheen Latex, MPI Gloss Level 2
45 .....Interior Primer Sealer
46 .....Interior Enamel Undercoat
47 .....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
48 .....Interior Alkyd, Gloss, MPI Gloss Level 6
50 .....Interior Latex Primer Sealer
51 .....Interior Alkyd, Eggshell, MPI Gloss Level 3
52 .....Interior Latex, MPI Gloss Level 3
53 .....Interior Latex, Flat, MPI Gloss Level 1
54 .....Interior Latex, Semi-Gloss, MPI Gloss Level 5
59 .....Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss
60 .....Interior/Exterior Latex Porch & Floor Paint, Low Gloss
66 .....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved)
67 .....Interior Latex Fire Retardant, Top-Coat (ULC Approved)
68 .....Interior/ Exterior Latex Porch & Floor Paint, Gloss
71 .....Polyurethane, Moisture Cured, Clear, Flat

77 .....Epoxy Cold Cured, Gloss
79 .....Marine Alkyd Metal Primer
90 .....Interior Wood Stain, Semi-Transparent
91 .....Wood Filler Paste
94 .....Exterior Alkyd, Semi-Gloss
95 .....Fast Drying Metal Primer
98 .....High Build Epoxy Coating
99 .....Sealer, Water-based, for Concrete Floors
101 .....Epoxy Anti-Corrosive Metal Primer
107 .....Primer, Rust-Inhibitive, Water-based
108 .....High Build Epoxy Coating, Low Gloss
113 .....Elastomeric, Pigmented, Exterior, Water-based, Flat
114 .....Interior Latex, Gloss
115 .....Epoxy-Modified Latex, Interior Gloss (MPI gloss level 6)
118 .....Dry Fall, Latex Flat
119 .....Exterior Latex, High Gloss (acrylic)
134 .....Galvanized Water Based Primer
135 .....Non-Cementitious Galvanized Primer
138 .....Interior High Performance Latex, MPI Gloss Level 2
139 .....Interior High Performance Latex, MPI Gloss Level 3
140 .....Interior High Performance Latex, MPI Gloss Level 4
141 .....Interior High Performance Latex (SG) MPI Gloss Level 5
144 .....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 2)
145 .....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 3)
146 .....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 4)
151 .....Light Industrial Coating, Interior, Water-based, (MPI Gloss Level 3)
153 .....Light Industrial Coating, Interior, Water-based, (MPI Gloss Level 4)
163 .....Exterior Water Based Semi-Gloss Light Industrial Coating, MPI Gloss Level 5
164 .....Exterior, Water Based, Gloss, Light Industrial Coating, MPI Gloss Level 6

H. Society for Protective Coatings (SSPC):

SSPC SP 1-82(R2004) .....Solvent Cleaning
SSPC SP 2-82(R2004) .....Hand Tool Cleaning
SSPC SP 3-28(R2004) .....Power Tool Cleaning
SSPC SP 10/NACE No.2.....Near-White Blast Cleaning
SSPC PA Guide 10.....Guide to Safety and Health Requirements

I. Maple Flooring Manufacturer's Association (MFMA):

J. U.S. National Archives and Records Administration (NARA):

29 CFR 1910.1000.....Air Contaminants

K. Underwriter's Laboratory (UL)

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

2.2 PAINT PROPERTIES:

A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

C. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer and use only to recommended limits.

D. VOC Content: For field applications that are inside the weatherproofing system, paints and coating to comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 gram/liter.
2. Non-flat Paints and Coatings: 150 gram/liter.
3. Dry-Fog Coatings: 400 gram/liter.
4. Primers, Sealers, and Undercoaters: 200 gram/liter.
5. Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 gram/liter.
6. Zinc-Rich Industrial Maintenance Primers: 340 gram/liter.
7. Pretreatment Wash Primers: 420 gram/liter.
8. Shellacs, Clear: 730 gram/liter.
9. Shellacs, Pigmented: 550 gram/liter.

E. VOC test method for paints and coatings is to be in accordance with 40 CFR 59 (EPA Method 24). Part 60, Appendix A with the exempt compounds' content determined by Method 303 (Determination of Exempt Compounds) in the South Coast Air Quality Management District's (SCAQMD) "Laboratory Methods of Analysis for Enforcement Samples" manual.

2.3 PLASTIC TAPE:

A. Pigmented vinyl plastic film in colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or specified.

B. Pressure sensitive adhesive back.

C. Widths as shown on construction documents.

2.4 BIOBASED CONTENT

A. Paint products shall comply with following bio-based standards for biobased materials:

Material Type	Percent by Weight
Interior Paint	20 percent biobased material
Interior Paint- Oil Based and Solvent Alkyd	67 percent biobased material
Exterior Paint	20 percent biobased material
Wood & Concrete Stain	39 percent biobased content
Polyurethane Coatings	25 percent biobased content
Water Tank Coatings	59 percent biobased content
Wood & Concrete Sealer- Membrane Concrete Sealers	11 percent biobased content
Wood & Concrete Sealer- Penetrating Liquid	79 percent biobased content

B. The minimum-content standards are based on the weight (not the volume) of the material.

PART 3 - EXECUTION

3.1 JOB CONDITIONS:

A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
   1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
   2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day’s work.

B. Atmospheric and Surface Conditions:
   1. Do not apply coating when air or substrate conditions are:
      a. Less than 3 degrees C (5 degrees F) above dew point.
      b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the COR and the product manufacturer. Under no circumstances are application conditions to exceed manufacturer recommendations.
      c. When the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer’s printed instructions.
   2. Maintain interior temperatures until paint dries hard.
   3. Do no exterior painting when it is windy and dusty.
   4. Do not paint in direct sunlight or on surfaces that the sun will warm.
   5. Apply only on clean, dry and frost-free surfaces except as follows:

a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces only when allowed by manufacturer's printed instructions.
b. Concrete and masonry when permitted by manufacturer's recommendations, dampen surfaces to which water thinned acrylic and cementitious paints are applied with a fine mist of water on hot dry days to prevent excessive suction and to cool surface.

6. Varnishing:
   a. Apply in clean areas and in still air.
   b. Before varnishing vacuum and dust area.
   c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 INSPECTION:

A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 GENERAL WORKMANSHIP REQUIREMENTS:

A. Application may be by brush or roller. Spray application only upon acceptance from the COR in writing.
B. Furnish to the COR a painting schedule indicating when the respective coats of paint for the various areas and surfaces will be completed. This schedule is to be kept current as the job progresses.
C. Protect work at all times. Protect all adjacent work and materials by suitable covering or other method during progress of work. Upon completion of the work, remove all paint and varnish spots from floors, glass and other surfaces. Remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and leave work in a clean condition.
D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.
E. When indicated to be painted, remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.
F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.
G. Apply materials with a coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Government.
H. All coats are to be dry to manufacturer's recommendations before applying succeeding coats.
I. All suction spots or "hot spots" in plaster after the application of the first coat are to be touched up before applying the second coat.
J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

3.4 SURFACE PREPARATION:

A. General:

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
2. See other sections of specifications for specified surface conditions and prime coat.
3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer’s instructions and as herein specified, for each particular substrate condition.
4. Clean surfaces before applying paint or surface treatments with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   a. Concrete: 12 percent.
   b. Masonry (Clay and CMU’s): 12 percent.
   c. Wood: 15 percent.
   d. Gypsum Board: 12 percent.
   e. Plaster: 12 percent.

B. Wood:

1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
   a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
   b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
   a. Thin filler in accordance with manufacturer's instructions for application.

b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

C. Ferrous Metals:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). 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:

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. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 05 13, MASONRY MORTARING. Do not fill weep holes. Finish to match adjacent surfaces.
5. 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.

6. 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. Use same kind of primer specified for exposed face surface.
   a. Exterior wood: MPI 7 (Exterior Oil Wood Primer) for new construction and MPI 5(Exterior Alkyd Wood Primer) for repainting bare wood primer except where MPI 90 (Interior Wood Stain, Semi-Transparent) is scheduled.
   b. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
   c. Transparent finishes as specified under “Transparent Finishes on Wood Except Floors Article” and “Finish for Wood Floors Article”.
2. Apply two (2) coats of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
3. Apply one (1) coat of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.
4. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.
5. Apply MPI 67 (Interior Latex 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: (High Build Epoxy Coating) finish is specified.
2. Zinc-coated steel and iron: 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)
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 53 (Interior Latex, Flat), MPI Gloss Level 1 // MPI 52 (Interior Latex, MPI Gloss Level 3) MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) MPI 114 (Interior Latex, Gloss) finish: Use MPI 53 (Interior Latex, MPI Gloss Level 3) MPI 52 (Interior Latex, MPI Gloss Level 3) MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) MPI 114 (Interior Latex, Gloss) respectively.
2. Primer: Loxon Concrete & Masonry Primer-Sealer

H. Gypsum Plaster and Veneer Plaster:
1. Surfaces scheduled to receive vinyl coated fabric wall covering: Use MPI 45 (Interior Primer Sealer).
2. MPI 45 (Interior Primer Sealer), except use MPI 50 (Interior Latex Primer Sealer) when an alkyd flat finish is specified.
3. Surfaces scheduled to have MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) MPI 52 (Interior Latex, MPI Gloss Level 3) MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) MPI 114 (Interior Latex, Gloss) finish: Use MPI 10 MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) MPI 52 Latex, MPI Gloss Level 3) MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) MPI 114 (Interior Latex, Gloss) respectively.

I. Brick Masonry and Interior Surfaces of Ceilings and Walls:
1. MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) MPI 52 (Interior Latex, MPI Gloss Level 3) MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) MPI 114 (Interior Latex, Gloss) except use two (2) coats where substrate has aged less than six (6) months.

3.8 EXTERIOR FINISHES:

A. Wood:
1. Do not apply finish coats on surfaces concealed after installation, top and bottom edges of wood doors and sash, or on edges of wood framed insect screens.
2. Two (2) coats of MPI 10 Exterior Latex, Flat) MPI 11 (Exterior Latex, Semi-Gloss) MPI 119 (Exterior Latex, High Gloss (acrylic) on exposed surfaces, except where transparent finish is specified.
3. Two (2) coats of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss) MPI 71 (Polyurethane, Moisture Cured, Clear Flat) for transparent finish.

B. Brick and Concrete:
1. General:
   a. Mix as specified in manufacturer's printed directions.

b. Do not mix more paint than can be used within four (4) hours after mixing. Discard paint that has started to set.
c. Dampen warm surfaces above 24 degrees C (75 degrees F) with fine mist of water before application of paint. Do not leave free water on surface.
d. Cure paint with a fine mist of water as specified in manufacturer's printed instructions.

2. Use two (2) coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious), unless specified otherwise.

3.9 INTERIOR FINISHES:

A. Metal Work:
1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) unless specified otherwise.
b. Two (2) coats of MPI 48 (Interior Alkyd Gloss) MPI 51 (Interior Alkyd, Eggshell).
c. One (1) coat of MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss) on exposed interior surfaces of alkyd-amine enamel prime finished windows.
d. Asphalt Coated Metal: One (1) coat MPI 1 (Aluminum Paint).
e. Ferrous Metal over 94 degrees K (290 degrees F): Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One (1) coat MPI 22 (High Heat Resistant Coating.

B. Gypsum Board:
1. One (1) coat of MPI 45 (Interior Primer Sealer) MPI 46 (Interior Enamel Undercoat) plus one (1) coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3).
2. Two (2) coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2).
3. One (1) coat of MPI 45 (Interior Primer Sealer) MPI 46 (Interior Enamel Undercoat) plus one (1) coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) or MPI 114 (Interior Latex, Gloss).
4. One (1) coat of // MPI 45 (Interior Primer Sealer) // MPI 46 (Interior Enamel Undercoat) // plus one (1) coat of MPI 48 (Interior Alkyd Gloss).

C. Plaster:
1. One (1) coat of // MPI 45 (Interior Primer Sealer) // MPI 46 (Interior Enamel Undercoat) // MPI 50 (InterioSMPI 50 (Interior Latex Primer Sealer) plus one (1) coat of 139 (Interior High Performance Latex, MPI Gloss level 3).
2. One (1) coat MPI 101 (Cold Curing Epoxy Prime).

D. Masonry and Concrete Walls:
1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.

2. Two (2) coats of // MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) // // MPI 52 (Interior Latex, MPI Gloss Level 3) // // MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) // // MPI 114 (Interior Latex, Gloss) //.
3. Two (2) coats of // MPI 138 (Interior High Performance Latex, MPI Gloss Level 2) // // MPI 139 (Interior High Performance Latex, MPI Gloss Level 3) // // MPI 140 (Interior High Performance Latex MPI Gloss Level 4) // // MPI 141 (Interior High Performance Latex MPI Gloss Level 5) // // MPI 114 (Interior Latex, Gloss) //.

E. Wood:
1. Sanding:
   a. Use 220-grit sandpaper.
   b. Sand sealers and varnish between coats.
   c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.
2. Sealers:
   a. MPI 31 (gloss) or MPI 71 (flat) thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.
   b. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
   c. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
   d. Sand as specified.
3. Paint Finish:
   a. One (1) coat of // MPI 45 (Interior Primer Sealer) // // MPI 46 (Interior Enamel Undercoat) // plus one (1) coat of MPI 47 (Interior Alkyd, Semi-Gloss.
   b. One (1) coat // MPI 66 (Interior Alkyd Fire retardant, Clear Top-Coat (UL Approved) // // MPI 67 (Interior Latex Fire Retardant, Top-Coat (UL Approved), intumescent type, on exposed wood // in attics with floors used for mechanical equipment // // and above ceilings where shown //.
   c. One (1) coat of // MPI 45 Interior Primer Sealer) // // MPI 46 (Interior Enamel Undercoat) // plus one (1) coat of MPI 48 (Interior Alkyd Gloss).
   d. Two (2) coats of MPI 51 (Interior Alkyd, Eggshell).
4. Transparent Finishes on Wood Except Floors.
   a. Natural Finish:
      One (1) coat of sealer // MPI 31 (gloss) // // MPI 71 (flat) // thinned with thinner recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.

Two (2) coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat // MPI 31 (Polyurethane, Moisture Cured, Clear Gloss.

b. Stain Finish:

One (1) coat of MPI 90 (Interior Wood Stain, Semi-Transparent).

Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.

One (1) coat of sealer // MPI 31 (gloss) // // MPI 71 (flat) // thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.

Two (2) coats of // MPI 71 (Polyurethane, Moisture Cured, Clear Flat) // // MPI 31 (Polyurethane Moisture Cured, Clear Gloss) //.

c. Varnish Finish:

One (1) coat of sealer // MPI 31 (gloss) // // MPI 71 (flat) // thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.

Two (2) coats of // MPI 71 (Polyurethane, Moisture Cured, Clear Flat) // // MPI 31 (Polyurethane Moisture Cured, Clear Gloss) //.

5. Finish for Wood Floors:

a. Hardwood Flooring:

Apply MPI 91 (Wood Filler Paste) to open grained wood. Remove surplus filler and wipe clean.

Sand lightly when dry. Remove dust.

Apply two (2) coats of CID-A-A-2335 (Sealer, Surface).

Apply two (2) thin coats of P-W-155 (Wax Floor, Water Emulsion) and machine buff to uniform luster.

F. Miscellaneous:

1. Apply where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
2. MPI 1 (Aluminum Paint): Two (2) coats of aluminum paint.

3.10 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.

3.11 PAINT COLOR:

A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.

B. For additional requirements regarding color see Articles, “REFINISHING EXISTING PAINTED SURFACE” and “MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE”.

C. Coat Colors:

1. Color of priming coat: Lighter than body coat.
2. Color of body coat: Lighter than finish coat.
3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:

1. Paint to match color of casework where casework has a paint finish.
2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.12 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 in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified below.

C. Paint various systems specified in Division 02 – EXISTING CONDITIONS, Division 21 – FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 – HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 – ELECTRONIC SAFETY AND SECURITY.

D. Paint after tests have been completed.

E. Omit prime coat from factory prime-coated items.

F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe

basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.

G. Omit field painting of items specified in “BUILDING AND STRUCTURAL WORK FIELD PAINTING”; “Building and Structural Work not Painted”.

H. Color:

1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:
   a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
   b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
   c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
   d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
   e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.
   f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.

I. Apply paint systems on properly prepared and primed surface as follows:

1. Exterior Locations:
   a. Apply two (2) coats of MPI 9 (Exterior Alkyd Enamel) to the following ferrous metal items:
      Vent and exhaust pipes with temperatures under 94 degrees C(201 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
   b. Apply two (2) coats of MPI 11 (Exterior Latex, Semi-Gloss) to galvanized and zinc-copper alloy metal.
   c. Apply one (1) coat of MPI 22 (High Heat Resistant Coating), 650 degrees C (1200 degrees F) to incinerator stacks, boiler stacks, and engine generator exhaust.
2. Interior Locations:
   a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) to following items:
      Metal under 94 degrees C (201 degrees F) of items such as bare piping, fittings, hangers and supports.

Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.

Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.

b. Apply one (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of MPI 114 (Interior Latex, Gloss) on finish of insulation on boiler breeching and uptakes inside boiler house, drums, drumheads, oil heaters, feed water heaters, tanks and piping.

c. Apply two (2) coats of MPI 22 (High Heat Resistant Coating) to ferrous metal surface over 94 degrees K (290 degrees F) of following items:

Garbage and trash incinerator.

Medical waste incinerator.

Exterior of boilers and ferrous metal in connection with boiler settings including supporting members, doors and door frames and fuel oil burning equipment.

Steam line flanges, bare pipe, fittings, valves, hangers and supports over 94 degrees K (290 degrees F).

Engine generator exhaust piping and muffler.

d. Paint electrical conduits containing cables rated 600 volts or more using two (2) coats of MPI 9 (Exterior Alkyd Enamel) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.

3. Other exposed locations

3.13 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 in Finish Schedule or Construction Documents.
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.

3.14 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
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
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
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler	Red	Red	White	Auto Spr
Standpipe	Red	Red	White	Stand
Sprinkler	Red	Red	White	Drain

3.15 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.

- - - E N D - - -

SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies code required signs.

1.2 RELATED WORK

A. Section 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE: Concrete Post Footings.

B. Section 05 12 00, STRUCTURAL STEEL FRAMING: Structural Steel Supports.

C. Division 26, ELECTRICAL Lighted EXIT signs for egress purposes are specified under and Electrical Work.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide signage that is the product of one manufacturer, who has provided signage as specified for a minimum of three (3) years. Submit manufacturer’s qualifications.

B. Installer’s Qualifications: Minimum three (3) years’ experience in the installation of signage of the type as specified in this Section. Submit installer’s qualifications.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. 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.

C. 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.

D. Sign Location Plan, showing location, type and total number of signs required.

E. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.

F. Full size layout patterns for dimensional letters.

G. Manufacturer’s qualifications.

H. Installer’s qualifications.

1.5 DELIVERY AND STORAGE

A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.

B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.

C. Deliver signs only when the site and mounting services are ready for installation work to proceed.

D. Store products in dry condition inside enclosed facilities.

1.6 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21, “Warranty of Construction”.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Architectural Manufacturers Association (AAMA):

611-14 ..... Anodized Architectural Aluminum

2603-13 ..... Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

C. American National Standards Institute (ANSI):

A117.1-09..... Accessible and Usable Buildings and Facilities

D. ASTM International (ASTM):

A36/A36M-19 ..... Carbon Structural Steel

A240/A240M-20 ..... Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A666-15..... Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

A1011/A1011M-18a ..... Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

B36/B36M-18 ..... Brass Plate, Sheet, Strip, and Rolled Bar

B152/B152M-19 ..... Copper Sheet, Strip, Plate, and Rolled Bar

B209-14..... Aluminum and Aluminum-Alloy Sheet and Plate

B209M-14..... Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B221-14..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

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

C1036-16 ..... Flat Glass

C1048-18 ..... Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass

C1349-17 ..... Architectural Flat Glass Clad Polycarbonate

D1003-13 .....Test Method for Haze and Luminous Transmittance of Transparent Plastics

D4802-16 .....Poly(Methyl Methacrylate) Acrylic Plastic Sheet

E. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

F. Federal Specifications (Fed Spec):

MIL-PRF-8184F .....Plastic Sheet, Acrylic, Modified.

MIL-P-46144C.....Plastic Sheet, Polycarbonate

G. National Fire Protection Association (NFPA):

70-14 .....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. Vinyl: Premium grade 0.1 mm (0.004 inch) thick machine cut, having a pressure sensitive adhesive and integral colors.

B. 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.

C. 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. Provide text, arrows, and symbols in size, colors, typefaces and letter spacing shown in construction documents. Text shall be a true, clean, accurate reproduction of typeface(s). Text shown in construction documents is for layout purposes only; final text for signs is listed in Sign Message Schedule.

2.3 INTERIOR SIGN TYPES

A. Conform to the VA Signage Design Manual.

B. Provide frame component system.

C. Component System Signs:

1. Provide interior sign system as follows:
   a. 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 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 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) 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.
      2) 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.
3. 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. Provide mechanical fasteners that can be added to the end caps that will secure it to rail back to make sign tamper resistant.
4. Joiners: Extruded using 6063T5 aluminum with a black anodized finish. Rail joiners connect rail backs together blindly, providing a butt joint between copy inserts.
5. 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.
6. 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.

7. 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. 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)

E. For ceiling mounted signs, provide mounting hardware on the sign that allows for sign disconnection, removal, reinstallation, and reconnection.

2.4 FABRICATION

A. Design interior signage components to allow for expansion and contraction for a minimum material temperature range of 38 degrees C (100 degrees F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.

B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Provide concealed fasteners wherever possible.

C. Shop fabricate so far as practicable. Fasten joints flush to conceal reinforcement, or weld joints, where thickness or section permits.

D. Level and assemble contract surfaces of connected members so joints will be tight and practically unnoticeable, without applying filling compound.

E. Signs: Fabricate with fine, even texture to be flat and sound.
   1. Maintain lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern.
   2. Plane surfaces to be smooth, flat and without oil-canning, free of rack and twist.
   3. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.

F. Finish extruded members to be free from extrusion marks. Fabricate square turns, sharp corners, and true curves.

G. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Miter edge joints to give appearance of solid material.

H. Do not manufacture signs until final sign message schedule and location review has been completed by the COR and forwarded to contractor.

I. Drill holes for bolts and screws. Mill smooth exposed ends and edges with corners slightly rounded.

J. Form joints exposed to weather to exclude water.

K. Movable Parts, Including Hardware: Cleaned and adjusted to operate as designed without binding or deformation of members. Center doors and covers in opening or frame.

1. Align contact surfaces fit tight and even without forcing or warping components.

L. Pre-assemble items in shop to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

M. Prime painted surfaces as required. Apply finish coating of paint for complete coverage with no light or thin applications allowing substrate or primer to show.

1. Finish surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate signs as shown on the construction documents.

B. 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.

- - - END - - -

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. SUMMARY:

1. Section Includes: Toilet and bath accessories at toilets and other areas indicated on drawings.

1.2 RELATED WORK

A. Section 09 30 13, CERAMIC/PORCELAIN TILING: Ceramic Toilet and Bath Accessories.

1.3 APPLICABLE PUBLICATIONS

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

B. American Society of Mechanical Engineers (ASME):

1. B18.6.4-98(R2005) Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws inch.

C. American Welding Society (AWS):

D10.4-86(2000) ..... Welding Austenitic Chromium-Nickle Stainless Steel Piping and Tubing.

D. ASTM International (ASTM):

A269/A269M-15a(2019)..... Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

A312/A312M-19 ..... Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

A653/A653M-20 ..... Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

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.

B30-20..... Copper Alloys in Ingot Form.

B75/B75M-20 ..... Seamless Copper Tube.

B221-14..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

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

B456-17..... Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

B824-17 ..... General Requirements for Copper Alloy Castings.

C1036-16 ..... Flat Glass.

C1048-18 ..... Heat-Strengthened and Fully Tempered Flat Glass.

D635-18 ..... Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

F446-19 ..... Grab Bars and Accessories Installed in the Bathing Area.

E. Federal Specifications (Fed. Spec.):

A-A-3002 ..... Mirror, Glass.

FF-S-107C(2) ..... Screws, Tapping and Drive.

WW-P-541/8B(1) ..... Plumbing Fixtures (Accessories, Land Use).

F. National Architectural Metal Manufacturers(NAAMM):

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

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and fabrication, anchorage and installation details.
2. Show mounting locations and heights.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.

D. Samples:

1. Full sized, complete assembly of each product specified.
2. Approved samples may be incorporated into project.

E. Certificates: Certify each product complies with specifications.

1. Soap dispensers: Certify soap dispensers are fabricated of material that will not be affected by liquid soap, aseptic detergents, and hexachlorophene solutions.

F. Qualifications: Substantiate qualifications comply with specifications.

1. Manufacturer with project experience list.

G. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Regularly manufactures specified products.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel:

1. Plate Or Sheet: ASTM A666, Type 304, 0.8 mm (0.031 inch) thick unless otherwise specified.
2. Tubing: ASTM A269/A269M, Grade TP 304, seamless or welded.
3. Pipe: ASTM A312/A312M; Grade TP 304.

2.2 PRODUCTS - GENERAL

A. Basis of Design: Refer to toilet accessories schedule in construction documents.

2.3 PAPER TOWEL DISPENSERS

A. Surface mounted type with sloping top.

B. Dispensing capacity for 300 sheets of any type of paper toweling.

C. Fabricate of stainless steel.

D. Provide door with continuous hinge at bottom, and spring tension cam lock or tumbler lock, keyed alike, at top, and refill sight slot in front.

2.4 TOILET TISSUE DISPENSERS

A. Double roll surface mounted type.

B. Mount on continuous backplate.

C. Removable spindle ABS plastic or chrome plated plastic.

D. Wood rollers are not acceptable.

2.5 GRAB BARS

A. Fed. Spec. WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and complying with ASTM F446.

B. Fabricate from stainless steel or nylon coated steel, use one type throughout project:

1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.

C. Mounting:

1. Other Types and Locations: Concealed type.

D. Bars:

1. Fabricate to 38 mm (1-1/2 inch) outside diameter.
   a. Stainless steel, minimum 1.2 mm (0.05 inch) thick.

E. Flange for Concealed Mounting:

1. Minimum 2.65 mm (0.1 inch) thick, maximum 79 mm (3-1/8 inch) diameter by 13 mm (1/2 inch) deep, with minimum three set screws for securing flange to back plate.
2. Insert grab bar through center of flange and continuously weld perimeter of grab bar flush to back side of flange.
3. In lieu of providing flange for concealed mounting, and back plate as specified, grab bar may be welded to back plate covered with flange.

F. Back Plates:
1. Minimum 2.65 mm (0.1046 inch) thick metal.
2. Fabricate in one piece, maximum 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
3. Provide spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on partitions.

2.6 CLOTHES HOOKS, ROBE OR COAT

A. Fabricate hook units from stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges and corners rounded smooth to thickness of metal, or 3 mm (1/8 inch) minimum radius.

2.7 MIRRORS

A. Fed. Spec. A-A-3002 metal frame; chromium finished steel, anodized aluminum, or stainless steel.

B. Mirror Glass:
1. Minimum 6 mm (1/4 inch) thick.
2. Set mirror in a protective vinyl glazing tape.

C. Frames:
1. Channel or angle shaped section with face of frame minimum 9 mm (3/8 inch) wide. Fabricate with square corners.

D. Mounting Bracket:
1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.

2.8 SOAP DISHES

A. Fed. Spec. WW-P-541/8B, Type VI, Holder.

B. Class 1, Soap, Surface Mounted:
1. One piece with provisions for exposed fasteners.
2. Fabricate from chromium plated brass approximately 115 by 95 mm (4 1/2 by 3-3/4 inches) overall size with drainage openings at bottom.

2.9 ACCESSORIES

A. Fasteners:
1. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.

2. Toggle Bolts: For use in hollow masonry or frame construction.
3. Sex bolts: For through bolting on thin panels.
4. Expansion Shields: Lead or plastic for solid masonry and concrete substrate as recommended by accessory manufacturer to suit application.
5. Screws:
   a. ASME B18.6.4.
   b. Fed. Spec. FF-S-107, Stainless steel Type A.

B. Adhesive: As recommended by manufacturer to suit application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Verify blocking to support accessories is installed and located correctly.
B. Verify location of accessories with Contracting Officer's Representative.
C. Provide labor or prep as required for VA-furnished and contractor installed or VA-furnished and installed components.

3.2 INSTALLATION

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
B. Install grab bars according to ASTM F446.
C. Set work accurately, in alignment and where indicated, parallel or perpendicular as required to line and plane of surface. Install accessories plumb, level, free of rack and twist.
D. Toggle bolt to steel anchorage plates in frame partitions and hollow masonry.
E. Install accessories to function as designed. Perform maintenance service without interference with performance of other devices.
F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance.
G. Align mirrors, dispensers and other accessories even and level, when installed in battery.
H. Install accessories to prevent striking by other moving, items or interference with accessibility.

3.3 CLEANING

A. After installation, clean toilet accessories according to manufacturer’s instructions.

3.4 PROTECTION

A. Protect accessories from damage until project completion.

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SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

This section covers recessed fire extinguisher cabinets.

1.2 RELATED WORK

A. Acrylic glazing: Section 08 80 00, GLAZING.

B. Field Painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

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

B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

1.4 APPLICATION PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Testing and Materials (ASTM):

D4802-15 .....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

Recessed type with flat trim of size and design shown.

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 12 24 00
WINDOW SHADES

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section includes cloth shades. Provide window shades complete, including brackets, fittings and hardware.

1.2 RELATED WORK:

A. Color of shade cloth: To be selected from manufacturer's full standard line.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualification: Submit evidence that the manufacture has a minimum of three (3) years' experience in providing item of type specified, and that the blinds have performed satisfactorily on similar installations. Submit qualifications.

B. Submit qualifications for installers who are trained and approved by manufacturer for installation of units provided.

1.4 SUBMITTALS:

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

B. Samples:

1. Shade cloth, each type, 610 mm (24 inch) square, including cord and ring, showing color, finish and texture.

C. Manufacturer's literature and data; showing details of construction and hardware for:

1. Cloth and window shades

D. Shop Drawings: Provide fabrication and installation details for cloth shades, including shade cloth materials, their orientation to rollers, and their seam and batten locations.

E. Manufacturer's warranty.

1.5 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their window shades for a minimum of five (5) years from date of installation and final acceptance by the Government. Submit manufacturer's warranty.

1.6 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced to in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

AA-V-00200B .....Venetian Blinds, Shade, Roller, Window, Roller, Slat, Cord, and Accessories

C. ASTM International (ASTM):

A240/A240M-14 ..... Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

B221-14..... Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

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

G21-13 ..... Determining Resistance of Synthetic Polymeric Materials to Fungi

D. Underwriters Laboratories Inc. (UL):

325-06(R2013) ..... Door, Drapery, Gate, Louver, and Window Operators and Systems

PART 2 - PRODUCTS

2.1 CLOTH SHADES:

A. Light-Filtering Shade Cloth: Woven fabric, stain and fade resistant.

1. Mounting: Surface mounted.
2. Configuration: Single solar shadecloth.
3. Weave: Net/Basketweave.
4. Composition: 25% Polyester, 75% PVC
5. Orientation on Shadeband: Up the bolt.
6. Openness Factor: 1 percent.
7. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Submit report for testing of shade cloth materials identical to products provided.
8. Drive-End Location: Right side of inside face of shade.
9. Shade Cloth Anti-Microbial Characteristics: ‘No Growth’ per ASTM G21 results for fungi ATCC9642, ATCC9677, and ATCC9645.

2.5 MATERIALS:

A. Stainless Steel: ASTM A240/A240M.

B. Extruded Aluminum: ASTM B221M (B221).

2.6 FASTENINGS:

A. Zinc-coated or cadmium plated steel or stainless steel fastenings of length and type recommended by manufacturer. Except as otherwise specified, provide fastenings for installation with various structural materials as follows:

Type of Fastening	Structural Material
Wood screw	Wood
Tap screw	Metal
Case-hardened, self-tapping screw in pre-drilled hole	Solid masonry, concrete
Screw or bolt in expansion shields	Solid masonry, concrete
Toggle bolts	Hollow blocks, gypsum wallboard, plaster

2.7 FABRICATION:

A. Fabricate cloth shades to fit measurements of finished openings obtained at site.

B. Cloth Shades: Rolling type, constructed of shade cloth mounted on rollers. Provide shade cloth with plain sides, and with hem at bottom to accommodate weight bar.

1. Provide separate shades for each individual sash within opening. Provide shade length that exceeds height of window by 305 mm (12 inches) measured from head to sill, in addition to material required to make-up hem:

a. Provide rollers with spindles, nylon bearings, tempered steel springs, and other related accessories required for positive action.

b. Provide rollers of diameter and wall thicknesses required to accommodate operating mechanisms, weights, and widths of shadebands indicated without deflection.

c. Provide rollers with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

d. Secure shade cloth to rollers to prevent wrinkling or folding, and on line parallel to axis of rollers so that shade hangs plumb.

e. Secure shade cloth with zinc-coated steel or stainless steel machine screws spaced not over 228 mm (9 inches) on centers.

f. Do not attach shade cloth to rollers with tacks.

g. Provide hem bar of extruded aluminum for entire width of shade band. Heat seal hem bar on all sides to prevent removal.

h. Provide eyelets with clear openings large enough to accommodate cords, without cutting into cloth when set.

i. Provide cords of sufficient length to permit shades to be drawn to bottom of opening with ends looped and held with cord rings. Attach cords to hems through metal eyelets in center of slats in bottom hems.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Measure openings before fabrication. Do not scale construction documents.

B. Cloth Shades: Mount window shades on end of face brackets, set on metal gussets, or casing of windows as required. Provide extension face brackets where necessary at mullions. In existing buildings, provide brackets similar to those on existing windows.

1. Locate rollers in level position as high as practicable at heads of windows.
2. Install shades to prevent infiltration of light over rollers.
3. Where extension brackets are necessary for alignment of shades, provide metal lugs, and rigidly anchor lugs and brackets.
4. Place brackets and rollers so that shades do not interfere with window and screen hardware.
5. Shade installation methods not specifically described, are subject to approval of Contracting Officer Representative (COR).

3.2 ADJUSTING:

A. Adjust and shades to operate smoothly, free from binding or malfunction throughout entire operational range.

3.3 CLEANING AND PROTECTION:

A. Clean shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions that ensure that shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged shades that cannot be repaired, in a manner approved by COR before time of Substantial Completion.

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SECTION 12 36 00
COUNTERTOPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies quartz agglomerate countertops.

1.2 RELATED WORK

A. Color and patterns: Refer to finish legend in construction documents for details.

1.3 SUBMITTALS

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

B. Shop Drawings

1. Show dimensions of section and method of assembly.
2. Show details of construction at a scale of ½ inch to a foot.

C. Samples:

1. 150 mm (6 inch) square samples each top.
2. Front edge, back splash, end splash and core with surface material and booking.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Hardboard Association (AHA):

A135.4-95.....Basic Hardboard

C. Composite Panel Association (CPA):

A208.1-09.....Particleboard

D. American Society of Mechanical Engineers (ASME):

A112.18.1-12.....Plumbing Supply Fittings

A112.1.2-12.....Air Gaps in Plumbing System

A112.19.3-08(R2004).....Stainless Steel Plumbing Fixtures (Designed for Residential Use)

E. American Society for Testing and Materials (ASTM):

A167-99 (R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

A1008-10.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength, Low Alloy

D256-10 .....Pendulum Impact Resistance of Plastic

D570-98(R2005) .....Water Absorption of Plastics

D638-10 .....Tensile Properties of Plastics

D785-08 .....Rockwell Hardness of Plastics and Electrical Insulating Materials

D790-10 .....Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D4690-99(2005).....Urea-Formaldehyde Resin Adhesives

F. Federal Specifications (FS):

A-A-1936 .....Adhesive, Contact, Neoprene Rubber

G. U.S. Department of Commerce, Product Standards (PS):

PS 1-95 .....Construction and Industrial Plywood

H. National Electrical Manufacturers Association (NEMA):

LD 3-05.....High Pressure Decorative Laminates

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quartz Agglomerate Material:

1. Quartz material composed of ~93 % natural quartz with pigments and resin.
2. Material shall have minimum physical and performance properties as specified. 3 cm (1-1/8 inch) product is typically for horizontal installation and 2 cm (3/4 inch) product for vertical installation.
3. Thickness:
   a. 2 cm (3/4 inch).
4. Edge treatment: Exposed Edge, Eased
5. Seam width: 1/16 inch nominal unless otherwise specified.
6. Backsplash: Applied.
7. Endsplash: Applied.

B. Quartz Performance Properties (TYPICAL RESULTS):

1.	Flexural Strength	> 5,300 psi	ASTM D790
2.	Flexural Modulus	5.3–5.7 X 106 psi	ASTM D790
3.	Compression Strength (Dry)	27,300 psi	ASTM C170
4.	Compression Strength (Wet)	24,400 psi	ASTM C170
5.	Hardness	7 Mohs Hardness Scale	
6.	Thermal Expansion	1.45 x 10-5 meter/meter deg C	ASTM D696
7.	Thermal Expansion	2.61 x 10-5 inch/inch deg F	ASTM D696
8.	Colorfastness	Passes	NEMA LD 3-3.3
9.	Gloss (60° Gardner)	45–50	ANSI Z124
10.	Wear and Cleanability Passes	CSA B45.5-11/IAPMO Z124-2011	
11.	Stain Resistance	Passes CSA B45.5-11/IAPMO Z124-2011	
12.	Fungal Resistance	No observed growth on product	ASTM G 21
13.	Bacterial Resistance	No observed growth on product	ASTM G 22

14.	High Temperature Resistance	None to slight effect	NEMA LD 3-3.6
	a. Temperature, 356 deg F		
15.	Boiling Water Resistance	None to slight effect NEMA LD 3-3.5	
16.	Freeze-Thaw Cycling	Unaffected	ASTM C1026
17.	Point Impact	Passes ANSI Z124.6.4.2	
18.	Ball Impact Resistance	No failure at 164 inches NEMA LD 3-3.8	
	a. Slabs, No fracture,1/2 lb. ball – 2cm and 3 cm		
19.	Static Coefficient of Friction	0.89 (Dry), 0.61 (Wet)	ASTM C1028
20.	Abrasion Resistance	139	ASTM C501
21.	Density	2.4 g/cm3	ASTM D792
22.	Water Absorption, Long-term	0.12%	ASTM C373
23.	Water Absorption, Short	< 0.04%	ASTM C373
24.	Moisture Expansion	< 0.01% average	ASTM C370
25.	Flammability	Class A, all colors	NFPA 101® Life Safety Code
26.	Flame Spread Index	FSI 0 for 3 cm	UL 723
27.	Flame Spread Index	FSI ≤ 5 for 2 cm	UL 723
28.	Smoke Developed Index	SDI ≤ 40 for 3 cm	UL 723
29.	Smoke Developed Index	SDI ≤ 75 for 2 cm	UL 723
30.	Flame Spread Value	0 for 3 cm	CAN/ULC-S102
31.	Flame Spread Value	5 for 2 cm	CAN/ULC-S102
32.	Smoke Developed Value	10 for 3 cm	CAN/ULC-S102
33.	Smoke Developed Value	50 for 2 cm	CAN/ULC S102
34.	Nominal Thickness	2 cm and 3 cm	
35.	Nominal Weight per square foot for 2cm thickness is 10 pounds		
36.	Nominal Weight per square foot for 3cm thickness is 15 pounds		

C. QUARTZ CERTIFICATIONS and APPROVALS:

1. NSF/ANSI Standard 51, Listed by NSF.
2. UL Environment/GREENGUARD Certified.
3. UL Environment/GREENGUARD Gold Certified.

2.10 COUNTERTOPS

A. Fabricate in largest sections practicable.

B. Fabricate with joints flush on top surface.

C. Fabricate countertops to overhang front of cabinets and end of assemblies 25 mm (one inch) except where against walls or cabinets.

D. Provide 1 mm (0.039 inch) thick metal plate connectors or fastening devices (except epoxy resin tops).

E. Join edges in a chemical resistant waterproof cement or epoxy cement, except weld metal tops.

F. Fabricate with end splashes where against walls or cabinets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installing countertops verify that wall surfaces have been finished as specified and that mechanical and electrical service locations are as required.

B. Secure countertops to supporting rails of cabinets with metal fastening devices, or screws through pierced slots in rails.

1. Where type, size or spacing of fastenings is not shown or specified, submit shop drawings showing proposed fastenings and method of installation.

3.2 PROTECTION AND CLEANING

A. Tightly cover and protect against dirt, water, and chemical or mechanical injury.

B. Clean at completion of work.

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SECTION 14 24 00

HYDRAULIC ELEVATOR – NEW

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the engineering, furnishing and installation of the complete hydraulic elevator system as described herein and as indicated on the contract drawings.

B. Items listed in the singular apply to each elevator in this specification except where noted.

ELEVATOR SCHEDULE	
Elevator Number	1
Clear Inside Platform	68”x101”
Rated Load – kg (lb)	5,000 lb
Contract Speed - m/s (fpm)	100
Total Travel – m (ft)	
Floors Served	3
Number of Openings	3
Entrance Type & Size	Two-speed side opening
Plunger Size	

1.2 RELATED WORK

A. Section 01 33 23 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.

B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.

C. SECTION 09 06 00, SCHEDULE FOR FINISHES: As a master format for construction projects, to identify interior and exterior material finishes for type, texture, patterns, color and placement.

E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.

F. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.

G. 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.

H. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.

J. Section 26 05 73, OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY: Requirements for installing the over-current protective devices to ensure proper equipment and personnel protection.

K. Section 26 24 16, PANELBOARDS: Low voltage panelboards.

L. Section 26 43 13, TRANSIENT-VOLTAGE SURGE SUPPRESSION: Surge suppressors installed in panelboards.

M. Section 26 51 00, INTERIOR LIGHTING: Fixture and ballast type for interior lighting.

1.3 QUALIFICATIONS

A. Approval by the COR is required for products and services of proposed manufacturers, suppliers, installers and must be contingent upon submission of certificates by the Contractor stating the following:

1. Elevator contractor is currently and regularly engaged in the installation of elevator equipment as one of his principal products.
2. Elevator contractor must have five (5) years of successful experience, trained supervisory personnel and facilities to install elevator equipment specified herein.
3. Elevator Mechanic (Installer) must have passed a Mechanic Examination approved by the U.S. Department of Labor and have technical qualifications of at least five years of experience in the elevator industry or 10,000 hours of field experience working in the elevator industry with technical update training. Apprentices must be actively pursuing Certified Elevator Mechanic status. Certification must be submitted for all workers employed in this capacity.

B. Welding at the project site must be performed by certified welders who have previously qualified by test as prescribed in American Welding Society Publications AWS Dl.1 to perform the type of work required. Certificates must be submitted for all workers employed in this capacity. A welding or hot work permit is required for each day and must be obtained from the VAMC safety department. Request permit one day in advance.

C. Electrical work must be performed by a Licensed Master Electrician and Licensed Journeymen Electricians as requirements by NEC. Certificates must be submitted for all workers employed in this capacity.

D. Approval must not be given to elevator contractors and manufacturers who have established on prior projects, either government, municipal, or commercial, a record of unsatisfactory elevator installations, have failed to complete awarded contracts within the contract period and do not have the requisite record of satisfactory performing elevator installations of similar type and magnitude.

E. Approval of Elevator Contractor’s equipment must be contingent upon their providing factory training, engineering and technical support, including all manuals, wiring diagrams and tools necessary for adjusting, maintenance, repair and testing of equipment to the VA for use by the VA’s designated Elevator Maintenance Service Provider.

F. Identifying an elevator maintenance service provider that must render services within one hour of receipt of notification, together with certification that the quantity and quality of replacement parts stock is sufficient to warranty continued operation of the elevator installation.

G. Equipment within a group of hydraulic elevators must be the product of the same manufacturer.

H. The Contractor must provide and install safety devices that have been subjected to tests witnessed and certified by an independent professional testing laboratory that is not a subsidiary of the firm that manufactures supplies or installs the equipment.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification. Elevator installation, meet the requirements of the latest editions published and adopted by the United States Department of Veterans Affairs on the date contract is signed.

B. Federal Specifications (Fed. Spec.):

J-C-30B - Cable and Wire, Electrical (Power, Fixed Installation)

J-C-580 – Cord, Flexible and Wire, Fixture

W-S-610 – Splice Connectors

W-C-596F - Connector, Plug, Electrical; Connector, Receptacle, Electrical

W-F-406E - Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible

HH-I-558C - Insulation, Blankets, Thermal (Mineral Fiber, Industrial Type)

W-F-408E - Fittings for Conduit, Metal, Rigid (Thick-Wall and Thin-wall EMT Type)

RR-W-410 - Wire Rope and Strand

TT-E-489J - Enamel, Alkyd, Gloss, Low VOC Content

QQ-S-766 - Steel, Stainless and Heat Resisting, Alloys, Plate, Sheet and Strip

C. American Society of Mechanical Engineers (ASME):

A17.1 - Safety Code for Elevators and Escalators

A17.2 - Inspectors Manual for Electric Elevators and Escalators

D. National Fire Protection Association:

NFPA 13 - Standard for the Installation of Sprinkler Systems

NFPA 70 - National Electrical Code (NEC)

NFPA 72 - National Fire Alarm and Signaling Code

NFPA 101 - Life Safety Code

NFPA 252 - Fire Test of Door Assemblies

E. International Building Code (IBC)

F. American Society for Testing and Materials (ASTM):

A1008/A1008M-09 - Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability

E1042-02 - Acoustically Absorptive Materials Applied by Trowel or Spray

G. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS):

SP-58 - Pipe Hangers and Supports

H. Society of Automotive Engineers, Inc. (SAE):
J517-91 - Hydraulic Hose, Standard

I. Gages:
For Sheet and Plate: U.S. Standard (USS)
For Wires: American Wire Gauge (AWG)

J. American Welding Society (AWS):
D1.1 - Structured Welding Code – Steel

K. National Electrical Manufacturers Association (NEMA):
LD-3 - High-Pressure Decorative Laminates

L. Underwriter's Laboratories (UL):
486A - Safety Wire Connectors for Copper Conductors
797 - Safety Electrical Metallic Tubing

M. Institute of Electrical and Electronic Engineers (IEEE)

N. Regulatory Standards:
VA Barrier Free Design Handbook H-18-13
Uniform Federal Accessibility Standards

O. National Elevator Industry, Inc.
NEII-1 Building Transportation Standards and Guidelines

1.5 SUBMITTALS

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

B. Before execution of work, furnish information to evidence full compliance with contract requirements for proposed items. Such information must include, as required: Manufacturer's Name, Trade Names, Model or Catalog Number, Nameplate Data (size, capacity and rating) and corresponding specification reference (Federal or project specification number and paragraph). All submitted drawings and related elevator material must be forwarded to the COR.

C. Shop Drawings:

1. Complete scaled and dimensioned layout in plan and section view showing the arrangement of equipment and all details of each elevator unit specified including:

a. Complete layout showing location of storage tank/pump assembly, controller, piping layout, outside diameter of cylinder/plunger assembly, size of car platform, car frame members and support assembly.

b. Car, guide rails, brackets, buffers and other components located in hoistway.

c. Rail bracket spacing and maximum vertical forces on guide rails in accordance with H-18-8.

d. Reaction at points of support and buffer impact loads.

e. Weight of principal parts.
f. Top and bottom clearances and over travel of the car.
g. Location of main line switch/shunt trip circuit breaker, switchboard panel, light switch and feeder extension points in the machine room.

2. Drawings of hoistway entrances and doors showing details of construction and method of fastening to the structural members of the building.
   a. If drywall construction is used to enclose hoistway, submit details of interface fastenings between entrance frames and drywall.
   b. Sill details including sill support.

D. Samples:
1. One each of stainless steel, 76 mm x 127 mm (3 in. x 5 in.).
2. One each of color floor covering.
3. One each of protection pads, 76 mm x 127 mm (3 in. x 5 in.) if used.
4. One each car and hoistway Braille plate sample.
5. One each car and hall button sample.
6. One each car and hall lantern/position indicator sample.
7. One each wall and ceiling material finish sample.
8. One each car lighting sample.

E. Name of manufacturer, type or style designation and applicable data of the following equipment must be shown on the elevator layouts:
1. Storage tank/pump assembly.
2. Pump and motor, HP and RPM rating, Voltage, Starting and Full Load Ampere, Number of phases and Gallons per minute.
3. Controller.
4. Starters and Overload Current Protection Devices.
5. Car Safety Device; Rupture Valve and Manual Shut Off Valves.
6. Electric Door Operator; HP, RPM, Voltage and Ampere rating of motor.
7. Hoistway Door Interlocks.
8. Car Buffers; maximum and minimum rated load, maximum rated striking speed and stroke.
9. Cab Ventilation Unit; HP rating and CFM rating.

F. Complete construction drawings of elevator car enclosure, showing dimensioned details of construction, fastenings to platform, car lighting, ventilation, ceiling framing, top exits and location of car equipment.

G. Complete dimensioned detail of vibration isolating foundations for storage tank/pump assembly.

H. Dimensioned drawings showing details of:
1. All signal and operating fixtures.
2. Car slide guides/roller guides.

3. Hoistway door tracks, hangers and sills.
4. Door operator, infrared curtain units.

I. Cut sheets or drawings showing details of controllers and supervisory panels.

J. Furnish certificates as required under: Paragraph "QUALIFICATIONS".

1.6 WIRING DIAGRAMS

A Provide three complete sets of paper and one electronic set of field wiring and straight-line wiring diagrams showing all electrical circuits in the hoistway, machine room and fixtures. Install one set coated with an approved plastic sealer and mounted in the elevator machine room as directed by the COR.

B. In the event field modifications are necessary during installation, diagrams must be revised to include all corrections made prior to and during the final inspection. Corrected diagrams must be delivered to the COR within thirty (30) days of final acceptance.

C. Provide the following information relating to the specific type of microprocessor controls installed:

1. Owner's information manual, containing job specific data on major components, maintenance and adjustment.
2. System logic description.
3. Complete wiring diagrams needed for field troubleshooting, adjustment, repair and replacement of components. Diagrams must be base diagrams, containing all changes and additions made to the equipment during the design and construction period.
4. Changes made during the construction and warranty period must be noted on the drawings in adequate time to have the finalized drawings reproduced for mounting in the machine room no later than six months prior to the expiration of the warranty period.

1.7 PERFORMANCE STANDARDS

A. The elevators must meet the highest standards of the industry and specifically the following:

1. Contract speed is high speed in either direction of travel with rated capacity load in the elevator. Speed variation under all load conditions, regardless of direction of travel, must not vary more than three (3) percent.
2. The controlled rate of change of acceleration and retardation of the car must not exceed 0.1G per ft/s/s and the maximum acceleration and retardation must not exceed 0.2G per ft/s/s.
3. Starting, stopping and leveling must be smooth and comfortable without appreciable steps of acceleration and deceleration.

B. Passenger door operators must open the car door and hoistway door at 76.2 cm (2.5 ft) per second and close at 30.5 cm (1 ft) per second.

C. Pressure: Fluid system components must be designed and factory tested for 500 psi operating pressure.

D. Floor level stopping accuracy must be within 3 mm (.125 in.) above or below the floor, regardless of load condition.

E. Noise and Vibration Isolation: All elevator equipment including their supports and fastenings to the building, must be mechanically and electrically isolated from the building structure to minimize objectionable noise and vibration transmission to car, building structure, or adjacent occupied areas of building.

F. Sound Isolation: Noise level relating to elevator equipment operation in machine room must not exceed 80 decibels. All db readings must be taken three (3) feet off the floor and three (3) feet from equipment.

G. Airborne Noise: Measured noise level of elevator equipment during operation must not exceed 50 decibels in elevator lobbies and 60 decibels inside car under any condition including door operation and car ventilation exhaust blower on its highest speed.

1.8 WARRANTY

A. Submit all labor and materials furnished regarding elevator system and installation to terms of "Warranty of Construction" articles of FAR clause 52.246-21. The One-Year Warranty and Guarantee Period of Service must commence and run concurrent after final inspection, completion of performance test and upon acceptance of each elevator.

B. During warranty period if a device is not functioning properly in accordance with specification requirements, more maintenance than the contract requires keeping device operational, device must be removed and a new device meeting all requirements must be installed as part of work until satisfactory operation of installation is obtained. Period of warranty must start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

1.9 POWER SUPPLY

A. Power supply requirements in each machine room, see Specification 26 05 19, Electrical specifications and Electrical drawings.

B. Main Line Fused Disconnect Switch/Shunt Trip Circuit Breaker for each controller must be located inside the machine room at the strike jamb side of the machine room door and lockable in the “Off” position.

C. Provide Surge Suppressors to protect the elevator equipment.

1.10 EMERGENCY POWER SUPPLY

A. Emergency power supply, its starting means, transfer switch for transfer of elevator supply from normal to emergency power, two pair of conductors in a conduit from an auxiliary contact on the transfer switch (open or close contacts as required by Elevator Controller Manufacturer) to terminals in the group elevator controller and other related work must be provided by the Electrical Contractor.

B. Upon loss of normal power supply there must be a delay before transferring to emergency power of 10 seconds minimum to 45 seconds maximum, the delay must be accomplished through an adjustable timing device.

C. Prior to the return of normal power an adjustable timed circuit must be activated that will cause all cars to remain at a floor if already there or stop and remain at the next floor if in flight. Actual transfer of power from emergency power to normal building power must take place after all cars are stopped at a floor with their doors open.

D. Car lighting circuits must be connected to the emergency power panel.

1.11 ELEVATOR MACHINE ROOM

A. Space has been allocated for the elevator machine room. Refer to Construction Documents.

1. Outfit a machine room that meets the requirements of ASME A17.1, NEC, NFPA and IBC. The elevator drive machine and elevator controller must be in the same code approved machine room.
2. Locate the shunt trip breaker/main line disconnect and machine room light switch on the lock side of the door inside the machine room.
3. Locate sprinkler pipes to provide 213.3 cm (7 ft) head clearance. Do not locate sprinkler heads, heat detectors and smoke detectors directly over elevator equipment.

1.12 HOISTWAY LIGHTING

A. Provide lighting throughout the entire hoistway with 3-way switches at the top and bottom of the hoistway accessible from elevator hoistway entrance prior to entering the pit or stepping onto the car top.

B. Lighting must illuminate top of elevator cab when it is at the top floor and the pit when at the bottom floor.

1.13 TOOL CABINET

A. Provide a metal parts/tool cabinet, having two shelves and hinged doors. Cabinet must be 1219 mm (48 in.) high, 762 mm (30 in.) wide and 457 mm (18 in.) deep.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Where stainless steel is specified, it must be corrosion resisting steel complying with Fed. Spec. QQ-S-766, Class 302 or 304, Condition A with Number 4 finish on exposed surfaces. Stainless steel must have the grain of belting in the direction of the longest dimension and surfaces must be smooth and without waves. During installation stainless steel surfaces must be protected with a suitable material.

B. Where cold rolled steel is specified it must be low-carbon steel rolled to stretcher level standard flatness, complying with ASTM A109.

2.2 MANUFACTURED PRODUCTS

A. Materials, devices and equipment furnished must be of current production by manufacturers regularly engaged in the manufacture of such items. The elevator equipment, including controllers, door operators and supervisory system must be the product of manufacturers of

established reputation, provided such items are capably engineered and produced under coordinated specifications to ensure compatibility with the total operating system.

B. Manufacturers of equipment assemblies which include components made by others must assume complete responsibility for the final assembled unit. Components must be compatible with each other and with the total assembly for the intended service.

C. Mixing of manufactures related to a single system or group of components must be identified in the submittals.

D. Key operated switches provided for this elevator installation must be provided with four (4) keys for each individual switch or lock. Provide different key tumblers for different switch and lock functions. Each key must have a tag bearing a stamped or etched legend identifying its purpose.

2.3 CONDUIT AND WIREWAY

A. Provide new conduit and wireway. Install electrical conductors, except traveling cables, in rigid zinc-coated steel or aluminum conduit, electrical metallic tubing or metal wireways. Rigid conduit smaller than 19 mm (.75 in.) or electrical metallic tubing smaller than 12.5 mm (.50 in.) electrical trade size must not be used. All raceways completely embedded in concrete slabs, walls, or floor fill must be rigid steel conduit. Wireway (duct) must be installed in the hoistway and to the controller and between similar apparatus in the elevator machine room. Fully protect self-supporting connections, where approved, from abrasion or other mechanical injury. Flexible metal conduit not less than 9.375 mm (.375 in.) electrical trade size may be used, not exceeding 45.7 cm (18 in.) in length unsupported, for short connections between risers and limit switches, interlocks and for other applications permitted by NEC.

B. All conduits terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations must have approved insulation bushings. Install a steel lock nut under the bushings if they are constructed completely of insulating materials. Protect the conductors at ends of conduits not terminating in steel cabinets or boxes by terminal fittings having an insulated opening for the conductors.

C. Rigid conduit and EMT fittings using set screws or indentations as a means of attachment must not be used.

D. Connect motors or other items subject to movement, vibration, or removal to the conduit or EMT systems with flexible, steel conduits.

2.4 CONDUCTORS

A. Conductors must be stranded or solid coated annealed copper in accordance with Federal Specification J-C-30B for Type RHW or THW. Where 16 and 18 AWG are permitted by NEC, single conductors, or multiple conductor cables in accordance with Federal Specification J-C-580 for Type TF may be used provided the insulation of single conductor cable and outer jacket of multiple conductor cable is flame retardant and moisture resistant. Multiple conductor cable must have color or number coding for each conductor. Conductors for control boards must be in

accordance with NEC. Joints or splices are not permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.

B. Provide all conduit and wiring between machine room, hoistway and fixtures.

C. All wiring must test free from short circuits or ground faults. Insulation resistance between individual external conductors and between conductors and ground must be a minimum of one megohm.

D. Where size of conductors is not given, voltage and amperes must not exceed limits set by NEC.

E. Provide equipment grounding. Ground the conduits, supports, controller enclosure, motor, platform and car frame and all other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires must be copper, green insulated and sized as required by NEC. Bond the grounding wires to all junction boxes, cabinets and wire raceways.

F. Terminal connections for all conductors used for external wiring between various items of elevator equipment must be solderless pressure wire connectors in accordance with Federal Specification W-S-610. The Elevator Contractor may, at his option, make these terminal connections on #10 gauge or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce-through serrated washers are not acceptable.

2.5 TRAVELING CABLES

A. All conductors to the car must consist of new flexible traveling cables conforming to the requirements of NEC. Traveling cables must run from the junction box on the car directly to the controller in the machine room. Junction boxes on the car must be equipped with terminal blocks. Terminal blocks having pressure wire connectors of the clamp type that meet UL 486A requirements for stranded wire may be used in lieu of terminal eyelet connections. Terminal blocks must have permanent indelible identifying numbers for each connection. Cables must be securely anchored to avoid strain on individual terminal connections. Flame and moisture resistant outer covering must remain intact between junction boxes. Abrupt bending, twisting and distortion of the cables must not be permitted.

B. Provide spare conductors equal to 10 percent of the total number of conductors furnished, but not less than 5 spare conductors in each traveling cable.

C. Provide shielded wires for the auto dial telephone system within the traveling cable, five (5) pair shielded wires for card reader, Ethernet (cables required for Wi-Fi and other systems, two (2) pair 14-gauge wires for 110 Volt power supply and wire for video display monitor if specified.

D. Traveling cables that contact the hoistway or elevator due to sway or change in position, provide shields or pads to the elevator and hoistway to prevent damage to the traveling cables.

E. Hardware cloth may be installed from the hoistway suspension point to the elevator pit to prevent traveling cables from rubbing or chafing and securely fastened and tensioned to prevent buckling. Hardware cloth is not required when traveling cable is hung against a flat wall.

2.6 CONTROLLER AND SUPERVISORY PANEL

A. UL/CSA Labeled Controller: Mount all assemblies, power supplies, chassis switches and relays on a steel frame in a NEMA Type 1 General Purpose Enclosure. Cabinet must be securely attached to the building structure.

B. Properly identify each device on all panels by name, letter, or standard symbol which must be neatly stencil painted or decaled in an indelible and legible manner. Identification markings must be coordinated with identical markings used on wiring diagrams. The ampere rating must be marked adjacent to all fuse holders. All spare conductors to controller and supervisory panel must be neatly formed, laced and identified.

C. Controller must be provided with wiring and components for additional future travel if required.

2.7 MICROPROCESSOR CONTROL SYSTEM

A. Provide a microprocessor control system with absolute position/speed feedback to control dispatching, signal functions, door operation, pump motor and hydraulic valve control. Complete details of the components and printed circuit boards, together with a complete operational description, must be submitted for approval. Provide closed transition SCR soft start.

B. Controller manufacturer must provide factory training, engineering and technical support, including all manuals, wiring diagrams and tools necessary for adjusting, maintenance, repair and testing of equipment to the VA for use by the VA's designated Elevator Maintenance Service Provider.

C. Microprocessor dispatching system must evaluate building traffic demand including number of elevators in service, hall calls, car calls, elevator position, direction of travel, load in elevator, door status and select an elevator to answer hall calls for least possible passenger wait times.

D. Provide low oil and hot oil shutdown features that must shut off the motor and pump and return the elevator to the lowest landing. Upon reaching the lowest landing, doors will open automatically allowing passengers to leave the elevator and then doors must close. All control buttons, except the door open button, alarm bell button and the call for help button must be made ineffective.

2.8 MACHINE ROOM MONITOR

A. Provide a monitor and keyboard in machine room.

B. The monitor must contain indicators to provide the following information:

1. The floor where each elevator is currently located.
2. The direction that each elevator is currently traveling or is scheduled to travel.
3. The location and direction of currently registered hall calls.
4. Elevators that are currently out of service.
5. Elevators that are currently bypassing hall calls.
6. Elevators that are currently engaged in passenger transfers.
7. Operations program under which entire group is currently operating.

8. Zone divisions of the entire group.
9. Door positions.
10. Status indication for elevators on independent service, car top inspection, fire service, earthquake protection and activated stop switch and alarm bell.

C. The maintenance terminal must be suitable for all troubleshooting procedures related to the specific type of microprocessor installed on this project.

2.9 EMERGENCY POWER OPERATION

A. The control system for Elevator(s) must provide for the operation of at least one car per elevator group on emergency power upon failure of the normal power supply.

B. Auxiliary equipment on elevator controllers, wiring between associated elevator controllers and wiring between elevator controllers and remote selector panel as required to permit the elevators to operate as detailed, must be provided by the Elevator Contractor.

C. Upon loss of normal power supply there must be a delay before transferring to emergency power of 10 seconds minimum to 45 seconds maximum, the delay must be accomplished through an adjustable timing device. After adjusting delay, the associated elevators must function the same as on normal power or as follows:

D. Prior to the return of normal power an adjustable timer circuit must activate that will cause all cars to remain at a floor if already there or stop and remain at the next floor if in flight. Actual transfer of power from auxiliary power to normal building power must take place after all cars are stopped at a floor with their doors open.

2.10 FIREFIGHTER'S SERVICE

A. Provide Firefighter's Service. Key switches must be barrel-key FEO-K1.
   1. Main Floor:
   2. Alternate Floor:
   3. Verify main and alternate floors with RE/CO or authorized representative.

2.11 INDEPENDENT SERVICE

A. Provide an INDEPENDENT SERVICE key switch on the face of the main car operating panel or a toggle switch in the service operating panel that must have its positions marked "ON" and "OFF". When the switch is in the "ON" position, the car must respond only to calls registered on its car dispatch buttons and must bypass all calls registered on landing push buttons. The car must start when a car call is registered, car call button or door close button is pressed, car and hoistway doors are closed and interlock circuits are made. When switch is returned to "OFF" position, normal service must be resumed.

2.13 PUMP, MOTOR AND VALVE ASSEMBLY

A. Provide new pump assembly for the control of the elevator self-contained in a unit fabricated of structural steel. The unit must consist of a hydraulic fluid pump, AC motor, oil control valves with down speed regulator, muffler, piping and fittings.

B. Submersible pump with the motor and oil control valve mounted above the tank are preferred to eliminate heat from the motor being transferred to the oil. Submersible motor and pump power units are acceptable but are best suited for lower traffic areas. Enclose V-belt power unit on four open sides with not less than 16-gauge steel removable panel sections. Provide a 50 mm (2 in.) minimum, 100mm (4 in.) maximum air space between the top of the panels and bottom of tank. Line panels on the interior side with one-inch rigid acoustical insulation board. Install metal belt guard that can be removed with hand tools for servicing and inspection.

C. Control valves must be electronically controlled. Hydraulic fluid flow must be controlled to ensure speed variation of not more than three (3) percent under all load conditions in either direction of travel. Locate the manual lowering valve, easily accessible, properly identified and not concealed within the storage tank. Mark the operating handle in red.

D. Pump must be designed for hydraulic elevator service, having a steady discharge without pulsation to give smooth and quiet operation. Pump output must be capable of lifting and lowering the elevator car with rated capacity, with a speed variation of no more than three (3) percent between no load and full load. Hydraulic fluid by-pass must discharge directly into storage tank.

E. Provide motor specifically designed for elevator service, synchronous speed of 1800 RPM, not to exceed nameplate full load current by more than 10% and rated 120 starts per hour without exceeding a rise of 40 degrees C.

F. Provide isolation pads to prevent transmission of pump and motor vibration to the building.

G. Install blowout-proof, non-hammering, oil-hydraulic muffler in the hydraulic fluid supply pressure line near power unit in machine room. Design muffler to reduce to a minimum any pulsation or noises that may be transmitted through the hydraulic fluid into the hoistway.

2.14 HYDRAULIC SYSTEM

A. Construct the storage tank of sheet steel, welded construction and a steel cover with means for filling, a minimum one-inch protected vent opening and a valve drain connection. Tank must be sized to pass through machine room door as shown on drawings. Provide marked sight gauges to monitor hydraulic fluid level. Tank must be sized to hold volume of hydraulic fluid required to lift elevator to stop ring, plus a reserve of not less than ten gallons. Provide a baffle in the bottom of the tank to prevent entry of any sediment or foreign particles into hydraulic system. Baffle must also minimize aeration of hydraulic fluid. Permissible minimum hydraulic fluid level must be clearly indicated. Hydraulic fluid must be of good grade to ensure free flow when cool and have minimum flash point of 380-400 degrees F. Provide initial supply of hydraulic fluid for operation of elevator.

1. Provide a means to maintain the fluid viscosity in the reservoir, pump and control valve at the manufacturer’s recommended operating temperature.
2. Provide a data plate on the tank frame indicating the characteristics of the hydraulic fluid used.

B. Provide and install connections between the storage tank, pump, muffler, operating valves and cylinder complete with necessary valves, pipe supports and fittings. Pipe must be minimum schedule 40 steel with threaded, flanged, or welded mechanical couplings. Size of pipe and couplings between cylinder and pumping unit must be such that fluid pressure loss is limited to 10 percent.

C. Hydraulic system working pressure must not exceed 500 psi under any load condition. Do not subject valves, piping and fittings to working pressure greater than those recommended by the manufacturer.

D. Support all horizontal piping. Place hangers or supports within 305 mm (12 in.) on each side of every change of direction of pipeline and space supports not over 304.8 cm (10 ft) apart. Secure vertical runs properly with iron clamps at sufficiently close intervals to carry weight of pipe and contents. Provide supports under pipe to floor.

   1. Provide all piping from machine room to hoistway, including necessary supports or hangers. If remote piping is underground or in damp inaccessible areas, install hydraulic piping thru PVC sleeve.

E. Install pipe sleeves where pipes pass through walls or floors. Set sleeves during construction. After installation of piping, equip the sleeves with snug fitting inner liner of fire rated insulation.

F. Provide an automatic shut-off valve in the oil supply line at the cylinder inlet. Weld inlet pipe to cylinder, threaded to receive shut-off valve. Activate the automatic shut-off valve when there is more than a ten percent increase in high speed in the down direction. When activated, this device must immediately stop the descent of the elevator and hold the elevator. The exposed adjustments of the automatic shut-off valve must have their means of adjustment sealed after being set to their correct position.

G. Provide external tank shut-off valve to isolate hydraulic fluid during maintenance operations.

H. Provide shut-off valves in the pit near the cylinder and in the machine room capable of withstanding 150 percent of design operating pressure. Each manual valve must have an attached handle.

I. Provide oil-tight drip pan for assembled pumping unit, including storage tank. Pan must be not less than 16-gauge sheet steel, with one-inch sides.

J. Components of the hydraulic system must be factory certified to withstand pressure equal to twice the calculated working pressure.

2.15 HYDRAULIC PLUNGER ASSEMBLY

A. Provide new cylinder and plunger sized to lift gross load the height specified. Factory test the plunger assembly at a pressure equal to twice the calculated working pressure, for strength and to ensure freedom from leakage. Provide bottom of cylinder head with internal guide bearing and top of cylinder head with removable packing gland. Victaulic type packing gland head must not be permitted.

1. Provide a bleeder valve located below the cylinder flange to release air or other gases from the system.
2. Equip cylinder with drip ring below the packing gland to collect leakage of hydraulic fluid.
3. Bolt the cylinder mounting brackets to footing channels that support the buffers.

B. Install a flexible tubing scavenger line with an electrically operated pump between the piston drip ring and oil storage tank. Scavenger line, pump and strainers must operate independently of hydraulic fluid pressure. Equip scavenger pump with a water float designed to prevent operation of the pump should the pit flood and designed to be manually reset. Secure pump and reservoir to the pit channels.

C. Plunger must be seamless steel tubing, turned smooth and true to within plus or minus .38 mm (0.015 in.) tolerance and no diameter change greater than .07 mm (0.003 in.) per-inch of length. Where plunger is multi-piece construction, machine the joints to assure perfectly matching surfaces.

1. Secure plunger to underside of platform supporting beams with fastenings capable of supporting four times the weight of the plunger. The platen plate must incorporate piston to car vibration isolation.
2. Provide a stop ring welded or screwed to the bottom of plunger that must prevent the plunger from leaving its cylinder.
   a. Plunger units that include future travel, locate the stop ring to permit only the actual travel and required runby.
3. Isolate plunger head from the platen plate to prevent corrosion or electrolysis.
4. Protect plunger, repair, or replace if gouged, nicked, or scored.

2.16 HYDRAULIC CYLINDER CASING AND WELL HOLE

A. The casing must be iron or steel not less than 9.375 mm (.375-in.) thick, at least 152 mm (6 in.) larger in diameter than the cylinder.

B. Provide PVC casing liner to fit inside steel casing. Fabricate liner with watertight bottom and a top flange gasket to seal plunger flange and form a complete, watertight, electrically non-conductive encasement of the entire unit.

C. Provide suitable well hole to accommodate casing. Coordinate the drilling of well hole and setting of the cylinder with construction of concrete pit. Provide watertight joint between the casing and the pit floor at bottom of pit.

D. Base bid on drilling hole in dirt, sand, rock, gravel, loam, boulders, hardpan, water, or other obstacles. Include the removal of all dirt and debris.

2.17 CAR BUFFERS

A. Provide two new spring buffers for each elevator. Securely fasten buffers and supports to the pit channels and in the alignment with striker plates on elevator. Buffers must have a permanently

attached metal plate indicating its stroke and load rating. Buffer anchorage must not puncture pit waterproofing.

B. Provide pipe stanchions and struts as required to properly support the buffer.

2.18 GUIDE RAILS, SUPPORTS AND FASTENINGS

A. Guide rails for car must be planed steel T-sections and weigh 27.5 kg/m (18.5 lb/ft)

B. Securely fasten guide rails to the brackets or other supports by heavy duty steel rail clips.

C. Provide car rail brackets of sufficient size and design to ensure substantial rigidity to prevent spreading or distortion of rails under any condition.

D. Guide rails must extend from channels on pit floor to within 76 mm (3 in.) of the underside of the concrete slab or grating at top of hoistway with a maximum deviation of 3.2 mm (.125 in.) from plumb in all directions. Provide a minimum of 19 mm (.75 in.) clearance between bottom of rails and top of pit channels.

E. Guide rail anchorages in pit must be made in a manner that will not reduce effectiveness of the pit waterproofing.

F. In the event inserts or bond blocks are required for the attachment of guide rails, the Contractor must furnish such inserts or bond blocks and must install them in the forms before the concrete is poured. Use inserts or bond blocks only in concrete or block work where steel framing is not available for support of guide rails. Expansion-type bolting for guide rail brackets will not be permitted.

G. Guide rails must be clean and free of any signs of rust, grease, or abrasion before final inspection. Paint the shank and base of the T-section with two field coats of manufacturer's standard enamel.

2.19 NORMAL AND FINAL TERMINAL STOPPING DEVICES

A. Mount new terminal slowdown switches and direction limit switches on the elevator or in hoistway to reduce speed and bring car to an automatic stop at the terminal landings.

1. Switches must function with any load up to and including 100 percent of rated elevator capacity at any speed obtained in normal operation.
2. Switches, when opened, must permit operation of elevator in reverse direction of travel.

B. Mount final terminal stopping switches in the hoistway.

1. Switches must be positively opened should the car travel beyond the terminal direction limit switches.
2. Switches must be independent of other stopping devices.
3. Switches, when opened, must remove power from pump motor and control valves preventing operation of car in either direction.

2.20 CROSSHEAD DATA PLATE AND CODE DATA PLATE

A. Permanently attach a non-corrosive metal Data Plate to car crosshead.

B. Permanently attach a Code Data Plate, in plain view, to the controller.

2.21 WORKMAN'S LIGHTS AND OUTLETS

A. Provide duplex GFCI protected type receptacles and lamp, with guards on top of elevator car and beneath platform.

B. The receptacles must be in accordance with Fed. Spec. W-C-596 for Type D7, 2-pole, 3-wire grounded type rated for 15 amperes and 125 volts.

2.22 CARTOP OPERATING DEVICE

A. Provide a cartop operating device.

B. The device must be activated by a toggle switch mounted in the device.
The switch must be clearly marked "INSPECTION" and "NORMAL" on the faceplate, with 6 mm (.25 in.) letters.

C. Movement of the elevator must be accomplished by the continuous pressure on a direction button and a safety button.

D. Provide an emergency stop switch, push to stop/pull to run.

E. Provide permanent identification for the operation of all components in the device.

F. The device must be permanently attached to the elevator crosshead on the side of the elevator nearest the hoistway doors used for accessing the top of the car.

2.23 LEVELING DEVICE

A. Elevator must be equipped with a new two-way leveling device to automatically bring the car to within 3 mm (.125 in.) of exact level with the landing for which a stop is initiated regardless of load in car or direction of travel.

B. If the car stops short or travels beyond the floor, the leveling device, within its zone must automatically correct this condition and maintain the car within 3 mm (.125 in.) of level with the floor landing regardless of the load carried.

2.24 EMERGENCY STOP SWITCHES

A. Provide an emergency stop switch, push to stop/pull to run, for each top-of-car device, pit, machine spaces, service panel and firefighter's control panel inside the elevator. Mount stop switches in the pit adjacent to pit access door, at top of the pit ladder 1219 mm (48 in.) above the bottom landing sill and 1219 mm (48 in.) above the pit floor adjacent to the pit ladder.

B. Each stop switch must be red in color and must have "STOP" and "RUN" positions legibly and indelibly identified.

2.25 MAIN CAR OPERATING PANEL

A. Provide new main car operating panel in the car enclosure on the front return panel for passenger elevators. The top floor car call push button must not be more than 1219 mm (48 in.) above the finished floor. "Vandal Resistant" car push buttons and indicator lights must be LED illuminated, round with a minimum diameter of 25 mm (1 in.). Each button must contain an integral registration LED light which must illuminate upon registration of a call and must extinguish when that call is answered.

B. One-piece hinged front faceplate with edges beveled 15 degrees must have the firefighter's service panel recessed into the upper section and the service operation panel recessed into the lower section fitted with hinged doors. Doors must have concealed hinges, be in the same front plane as the faceplate and fitted with key operated locks. Secure the faceplate with stainless steel tamperproof screws.

C. All terminology and tactile symbols on the faceplate must be on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. Use 6 mm (.25 in.) letters to identify all devices in the faceplate. The handicapped markings with contrasting background must be 12.5 mm (.50 in.) high raised .075 mm (.030 in.) on the plate. Surface mounted plates are not acceptable.

D. The upper section must contain the following items in order listed from top to bottom:

1. Elevator number, 12.5 mm (.50 in.) high with black paint for contrast.
2. Capacity plate information with black paint for contrast with freight loading class and number of passengers allowed.
3. LED illuminated digital car position indicator with direction arrows.
4. Emergency car lighting system consisting of a rechargeable battery, charger, controls and LED illuminated light fixture. The system must automatically provide emergency light in the car upon failure or interruption of the normal car lighting service and function irrespective of the position of the light control switch in the car. The system must maintain a minimum illumination of 1.0 foot-candle when measured 1219 mm (48 in.) above the car floor and approximately 305 mm (12 in.) in front of the car operating panel, for not less than four (4) hours.
5. Firefighter's Emergency Operation Panel must be 1676 mm (66 in.) minimum to 1828 mm (72 in.) maximum to the top of the panel above finished floor.
6. Firefighter's Emergency Indicator Light must be round with a minimum diameter of 25 mm (1 in.).
8. Key operated Independent Service Switch on the face of panel.
   (Delete if inside service panel.)
9. Provide a Door Hold Button on the faceplate above the call buttons. It must have "DOOR HOLD" indelibly marked on the button. Button must light when activated. When activated, the door must stay open for a maximum of one minute. To override hold timer, push a car call button or door close button.
10. Provide round "Vandal Resistant" car push buttons and indicator lights, minimum diameter of 25 mm (1 in.) and LED illuminated, corresponding to the floors served. Car call buttons must be legibly and indelibly identified by a floor number, letter or symbol not less than 12.5 mm (.50 in.) high in the face of the button or indicator.

11. Door Open and Door Close buttons must be located below the car call buttons. They must have “OPEN” and “CLOSE” legibly and indelibly identified by letters in the face of the respective button. The Door Open button must be located closest to the door jamb.
12. Red Emergency Alarm button that must be located below the car operating buttons. Mount the emergency alarm button not lower than 875 mm (35 in.) above the finished floor. It must be connected to audible signaling devices. Provide audible signaling devices including the necessary wiring.
13. Emergency Help push button must activate two-way communications by Auto Dial telephone system that is compatible with the VAMC’s telephone system. Help button must be LED illuminated and flash when call is acknowledged. Legibly and indelibly label the button “HELP”

in the face of the button with 12.5 mm (.50 in.) high letters.

E. The service operation panel, in the lower section must contain the following items:
1. Light switch labeled “LIGHTS” for controlling interior car lighting with its two positions marked “ON” and “OFF”.
2. Inspection switch that will disconnect normal operation and activate hoistway access switches at terminal landings. Switch must be labeled “ACCESS ENABLE” with its two positions marked “ON” and “OFF”.
3. Three position switch labeled “FAN” with its positions marked “HIGH”, “LOW” and “OFF” for controlling car ventilating blower.
4. Two position, spring return, toggle switch or push button to test the emergency light and alarm device. It must be labeled “TEST EMERGENCY LIGHT AND ALARM”.
5. Independent Service switch labeled “ON” and “OFF”. (Delete if key switch on face of panel).
6. Two-position emergency stop switch, when operated, must interrupt power supply and stop the elevator independently of regular operating devices. Emergency stop switch must be marked “PUSH TO STOP” and “PULL TO RUN”.

2.26 AUXILIARY CAR OPERATING PANEL

A. Provide an auxiliary car operating panel in the side wall of the elevator between the handrails immediately adjacent to the front entrance column strike jamb . The auxiliary car operating panel must contain only those controls essential to passenger (public) operation. The auxiliary car operating panel faceplate must match the main car operating panel faceplate in material and general design. Secure the faceplate with stainless steel tamperproof screws.
1. Provide round “Vandal Resistant” car push buttons and indicator lights, minimum diameter 25 mm (1 in.) and LED illuminated corresponding to the floors served. Car buttons and indicator lights must be legibly and indelibly identified by a floor number, letter, or symbol not less than 12.5 mm (.50 in.) high in the face of the button or indicator light corresponding to the main car operating panel buttons or indicator light.

2. Door "OPEN" and door "CLOSE" buttons must be closest to the door jamb and the alarm button must be 889 mm (35 in.) above the finished floor. The Door Open button must be located closest to the door.
3. Cross-connect all buttons in the auxiliary car operating panels to their corresponding buttons in the main car operating panel. Registration of a car call must cause the corresponding button to illuminate in the main and auxiliary car operating panel.
4. Emergency Help push button must activate two-way communications by auto dial telephone that is compatible with the VAMC's telephone system. Help button must be LED illuminated and flash when call is acknowledged. Legibly and indelibly label the button "HELP" in the face of the button with 12.5 mm (.50 in.) high letters.

B. All terminology and tactile symbols on the faceplate must be on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. Use 6 mm (.25 in.) letters to identify all devices in the faceplate. The tactile symbols with contrasting background must be 12.5 mm (0.5 in.) high raised .075 mm (.030 in.) on the plate. Surface mounted plates are not acceptable.

2.27 CAR POSITION INDICATOR

A. Provide an alpha-numeric digital car position indicator in the main car operating panel, consisting of numerals and arrows 63 mm (2.5 in.) high, to indicate position of car and direction of car travel. Locate position indicator at the top of the main car operating panel, illuminated by light emitting diodes.

2.28 AUDIO VOICE SYSTEM

A. Provide digitized audio voice system. Audio voice must announce floor designations, direction of travel and special announcements. The voice announcement system must be a natural sounding human voice that receives messages and must comply with ADA requirements for audible car position indicators. The voice announcer must have two separate volume controls, one for the floor designations and direction of travel and another for special announcements. The voice announcer must have a full range loudspeaker, located on top of the cab. The audio voice unit must contain the number of ports necessary to accommodate the number of floors, direction messages and special announcements. Install voice announcer per manufacturer's recommendations and instructions. The voice system must be the product of a manufacturer of established

reputation. Provide manufacturer literature and list of voice messages.

1. Fire Service Message.
2. "Please do not block doors".
3. Provide special messages as directed by COR.

2.29 AUTO DIAL TELEPHONE SYSTEM

A. Provide a complete, ADA compliant, auto dial communication system that is compatible with the VAMC's telephone system.

B. Two-way communication device shall be in full compliance with ASME A17.1 Rule 2.27.1.1 (2019) or later editions.

2.30 CORRIDOR OPERATING DEVICES

A. Provide new corridor operating device faceplates from not less than 3 mm (.125 in.) thick flat stainless steel with all edges beveled 15 degrees.

B. Corridor push button faceplates must be sized to accommodate corridor pictograph on faceplate. The centerline of the landing push buttons must be 1067 mm (42 in.) above the corridor floor.

C. Elevator Corridor Call Station Pictograph must be engraved in the faceplate.

D. Fasten corridor operating devices and signal device faceplates with stainless steel tamperproof screws.

E. All terminology and tactile symbols on the faceplate must be raised .030 inch with contrasting background, on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. The handicapped markings with contrasting background must be 12.5 mm (.50 in.) high raised .075 mm (.030 in.) on the plate, square or rectangular. Use 6 mm (.25 in.) letters to identify all other devices in the faceplate. Surface mounted plates are not acceptable.

F. Provide one risers of landing call buttons for each elevator or group of elevators as shown on contract drawings.

G. "Vandal Resistant" hall buttons and indicator lights must be LED illuminated upon registration of a call and shall extinguish when that call is answered.

H. The direction of each button must be legibly and indelibly identified by arrows not less than 12.5 mm (.50 in.) high in the face of each button. Provide a corresponding Braille plate on the left side of each button.

I. Hall call buttons must not re-open the doors while the car and hoistway doors are closing at that floor, the call must be registered for the next available elevator. Calls registered must be canceled if closing doors are re-opened by means of "DOOR OPEN" button or infrared curtain unit.

J. Provide emergency power indicator light, medical emergency key switch and indicator light, fire service recall key switch and indicator light, firefighter's recall instruction, communication failure light, audible enunciator and reset key switch in the fixture at the designated main floor.

K. Submit design of hall pushbutton fixtures for approval.

2.31 CORRIDOR ARRIVAL LANTERN/POSITION INDICATOR

A. Provide new combination corridor lantern/position indicator digital display mounted above hoistway entrances at each floor in healthcare facilities. For non-healthcare facilities provide combination fixtures only at main and alternate fire recall floors unless specified for all floors.

Provide each terminal landing with "UP" or "DOWN", minimum 63 mm (2.5 in.) high arrow lanterns and each intermediate landing with "UP" and "DOWN" arrow lanterns. Each lens must be LED illuminated of proper intensity, so shielded to illuminate individual lens only. The lenses in each lantern must be illuminated green to indicate "UP" travel and red to indicate "DOWN" travel. Lanterns must signal in advance of car arrival at the landing indicating the direction of travel. Corridor lanterns must not be illuminated when a car passes a floor without stopping. Each lantern must be equipped with an audible electronic chime which must sound once for "UPWARD" bound car and twice for "DOWNWARD" bound car. Audible signal must not sound when a car passes the floor without stopping. Provide adjustable sound level on audible signal. Car riding lanterns are not acceptable.

B. Install alpha-numeric digital position indicator between the arrival lanterns. Indicator faceplate must be stainless steel. Numerals must be not less than 63 mm (2.5 in.) high with direction arrows. Cover plates must be readily removable for re-lamping. The appropriate direction arrow must be illuminated during entire travel of car in corresponding direction.

2.32 HOISTWAY ACCESS

A. Provide new hoistway access switches for elevator at top terminal landing to permit access to top of car and at bottom terminal landing to permit access to pit. Elevators with side slide doors, mount the access key switch 182.8 cm (6 ft) above the corridor floor in the wall next to the strike jamb.

B. Exposed portion of each access switch or its faceplate must have legible, indelible legends to indicate "UP", "DOWN" and "OFF" positions.

C. Each access switch must be a constant pressure cylinder type lock having not less than five pins or five stainless steel disc combination with key removable only when switch is in the "OFF" position.

D. Lock must not be operable by any other key which will operate any other lock or device used for any other purpose at the VA Medical Center.

E. Arrange the hoistway switch to initiate and maintain movement of the car. When the elevator is operated in the down direction from the top terminal landing, limit the zone of travel to a distance not greater than the top of the car crosshead level with the top floor. Submit design and location of access switches for approval.

F. Provide emergency access for all hoistway entrances, keyways for passenger elevators.

2.33 HOISTWAY ENTRANCES: PASSENGER ELEVATORS

A. Provide complete entrances with sills, sill supports, hangers, hanger supports, tracks, angle struts, unit frames, door panels, fascia plates, toe guards, hardware, bumpers, sight guards and wall anchors.

B. Provide new one-piece stainless-steel sills grooved for door guides and recessed for fascia plates. Sills must have overall height of not less than 19 mm (.75 in.) set true, straight and level,

with hoistway edges plumb over each other and top surfaces flush with finished floor. Hoistway entrance frames and sills must be grouted solid full length after installation.

C. Construct hanger supports of not less than 9.375 mm (.375 in.) thick steel plate and bolted to strut angles.

D. Structural steel angles 76 mm x 76 mm x 9.375 mm (3 in. x 3 in. x .375 in.) must extend from top of sill to bottom of floor beam above and must be securely fastened at maximum 457 mm (18 in.) on center and at each end with two bolts.

E. Provide jambs and head soffits, of not less than 14-gauge stainless steel. Jambs and head soffits must be bolted/welded construction and provided with three anchors each side. Side jambs must be curved. Radius of curvature must be 89 mm (3.5 in.). Head jamb must be square and must overhang corridor face of side jambs by 6 mm (.25 in.). Rigidly fasten jambs and head soffits to building structure and grouted solid. After installation, protect jambs and head soffits to prevent damage to finish during construction.

F. Provide raised numerals or letters on cast, rear mounted plates for all openings. Numerals must be a minimum of 51 mm (2 in.) high, located on each side of entrance frame, with centerline of 1523 mm (5 ft) above the landing sill. The number plates must contain Braille.

G. Provide unique car number on every elevator entrance at designated main fire service floor level, minimum 76 mm (3 in.) in height.

H. Provide new stainless steel hoistway doors. Door panels must be flush hollow metal construction, not less than 32 mm (1.25 in.) thick, consisting of one continuous piece 16-gauge stainless steel on corridor side wrapped around the leading edge. Separate two plates by a sound-deadening material and reinforce by steel shapes welded to the plates at frequent intervals. Reinforce panels as required for installation of hangers, power-operating and door-opening devices. Top and bottom of door panels must have continuous stiffener channels welded in place. Reinforcement of the door panels must be a minimum of 1.0 mm (0.04 in.) in thickness and of the hat section type.

I. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with non-metallic sound-reducing tires. Equip hangers with adjustable ball-bearing rollers to take upward thrust of panels. Provide two removable non-metallic door gibs of approved material and a separate fire gib at the bottom of each door panel. Gibs must be replaceable without removing of door panel. One door panel for each entrance must bear a BOCA label, Underwriters' label, or other labels may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to the COR. Fasten stainless steel sight guard of 14-gauge metal, extending full height of panel, to leading edge of fast speed panel of two-speed doors.

J. Door panels for each entrance must bear a BOCA label, Underwriters' label or labels from other accredited test laboratories may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to the RE/CO or authorized representative.

K. Provide 14-gauge sheet steel fascia plates in hoistway to extend vertically from head of hanger support housing to sill above. Plates must be 76 mm (3 in.) wider than door opening of elevator and reinforced to prevent waves and buckles. Below bottom terminal landing and over upper terminal landing provide shear guards beveled back to and fastened to the wall.

L. Equip each hoistway entrance with new electrical/mechanical interlock, functioning as hoistway unit system, to prevent operation of elevator until all hoistway doors are locked in the closed position unless car is operating in the leveling zone or hoistway access switch is used.

M. Wiring installed from the hoistway riser to each door interlock must be NEC type SF-2 or equivalent.

2.34 CAR GUIDES

A. Provide new adjustable roller guides each assembled on a substantial metal base, to permit individual alignment to the guide rails.

B. Each guide must consisting of not less than three (3) wheels, each with durable, resilient oil-resistant material tires rotating on ball bearings having sealed-in lubrication. Assemble rollers on a substantial metal base and mount to provide continuous spring pressure contact of all wheels with the corresponding rail surfaces under all conditions of loading and operation. Secure the roller guides at top and bottom on each side of car frame and counterweight frame. All mounting bolts must be fitted with nuts, flat washers, split lock washers and if required, beveled washers.

C. Provide sheet metal guards to protect rollers on top of car.

D. Minimum diameter of car rollers must be 152 mm (6 in.). The entire elevator car must be properly balanced to equalize pressure on all guide rollers. Cars must be balanced in post-wise and front-to-back directions. Test for this balanced condition must be witnessed at time of final inspection.

E. Equip car with an auxiliary guiding device for each roller guide that must prevent the car from leaving the rails if the normal guides fail. These auxiliary guides must not, during normal operation, touch the guiding surfaces of the rails. Fabricate the auxiliary guides from hot rolled steel plate and mount between the normal guide shoes and the car frames. The auxiliary guides may be an extension of the normal guide shoe mounting plate if that plate is fabricated from hot rolled steel. The portion of the auxiliary guide which must contact the rail guiding surfaces in the event of loss of the normal guide must be lined with an approved bearing material to minimize damage to the rail guiding surfaces.

2.35 CAR FRAME: PASSENGER ELEVATORS

A. Car frame must be constructed of channel stiles, crosshead, gussets and braces securely bolted and/or welded. The entire assembly must be constructed to withstand unequal loading of platform. Car frame members must be constructed to relieve the car enclosure of all strains.

2.36 CAR PLATFORM: PASSENGER ELEVATORS

A. The platform must be designed to withstand the forces developed under the loading conditions specified. Provide car entrances with stainless steel sill with machined or extruded door guide

and recessed for platform guard. Cover underside and all exposed edges of wood filled platform with sheet metal of not less than 27-gauge, with all exposed joints and edges folded under. Fire resistant paint is not acceptable. Platform must have flexible composition flooring not less than 3 mm (.125 in.) thick. For color, see Section 09 06 00, SCHEDULE FOR FINISHES. Adhesive material must be type recommended by manufacturer of flooring. Lay flooring flush with threshold plate and base.

B. Provide a platform guard (toe guard) of not less than 12-guage sheet-steel on the entrance side, extend 76 mm (3 in.) beyond each side of entrance jamb. Securely brace platform guard to car platform and bevel bottom edge at a 60-75-degree angle from horizontal. Install platform in the hoistway, so that the clearance between front edge and landing threshold must not exceed 32 mm (1.25 in.).

C. Provide new isolation pads between the platform and platform frame. Use approved rubber pads or other approved material.

D. Provide adjustable diagonal brace rods to hold platform firmly within car suspension frame.

E. Balance car front to back and side to side. Provide balancing frame and weights, properly located, to achieve the required true balance.

F. Provide a bonding wire between frame and platform.

2.37 CAR ENCLOSURE: PASSENGER ELEVATORS

A. Car enclosure must have a dome height inside the cab of 244 cm (8 ft).

B. Securely fasten car enclosure to platform by through bolts located at intervals of not more than 457 mm (18 in.) running through an angle at the base of panels to underside of platform.

C. Front return wall panel, entrance columns, entrance head-jamb and transom must be 14-gauge stainless steel. Transom must be full width of cab. Side and rear walls must be constructed of 14-gauge cold rolled steel. Coat exterior of walls with mastic sound insulation material approximately 2.5 mm (.09375 in.) thick followed by a prime coat of paint.

F. Construct canopy of not less than 12-gauge steel.

G. Provide car top railings.

H. Provide a hinged top emergency exit cover. Exit must be unobstructed when open and must have mechanical stops on the cover. Provide an exit switch to prevent operation of the elevator when the emergency exit is open.

I. Provide duplex, GFCI protected receptacle in car. Locate flush-mounted receptacle on the centerline of the main car operating panel, 150 mm (6 in.) above the car floor.

J. Lighting for passenger elevators:

1. Provide stainless steel hanging ceiling frame. Construct frame of 3.125 mm (.125 in.) thick x 38 mm (1.50 in.) wide x 38 mm (1.50 in.) high “T” and “L” sections divide ceiling into six panels.

2. Provide LED illuminated car light fixtures above the ceiling panels. Maintain a minimum light level of 50-foot candles at 914 mm (36 in.) above the finished floor.

L. Provide a blower unit arranged to exhaust through an opening in the canopy. Provide a stainless or chrome plated fan grill around the opening. Provide 2-speed fan with rated air displacement of 250 cfm and 400 cfm at respective speeds. Mount fan on top of car with rubber isolation to prevent transmission of vibration to car structure. Provide screening over intake and exhaust end of blower. Provide a 3-position switch to control the unit in the service panel.

M. Provide car enclosure with two sets of handrails with centerlines 762 mm and 1067 mm (30 in. and 42 in.) above the car floor, circumference not to exceed 152 mm (6 in.).

1. Locate handrails 38 mm (1.50 in.) from cab wall. Install handrails on side and rear walls. Conceal all handrail fastenings. Handrails must be removable from inside the car enclosure.

N. Provide passenger car with center opening horizontal sliding doors. Door panels must be not less than 16-gauge sheet steel and not less than 32 mm (1.25 in.) thick flush type construction with the car side and leading edge wrapped in one continuous piece of 16-gauge stainless steel. Top and bottom of door panels must have continuous stiffener channels welded in place. Reinforcement of the door panels must be approximately 1.0 mm (0.04 in.) in thickness and of the hat section type. Reinforce each door panel for hangers, interlock mechanism, opening and closing devices. Do not use hangers that are constructed integrally with the door panels.

O. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with non-metallic sound-reducing tires. Equip hangers with adjustable ball-bearing rollers to take upward thrust of panels. Provide two non-metallic door gibs on each door panel and a separate fire gib. Gibs must be replaceable without removing of door panel. One door panel for each entrance must bear a BOCA label, Underwriters' label, or other labels may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to the COR. Fasten stainless steel sight guard of 14-gauge metal, extending full height of panel, to leading edge of fast speed panel of two-speed doors.

P. Provide new hardware, tracks, gibs, separate fire gibs, gate switch, door drive clutch assemblies and door restrictor.

2.38 POWER DOOR OPERATORS: PASSENGER ELEVATORS

A. Provide a new high-speed heavy-duty door operator to automatically open the car and hoistway doors simultaneously when the car is level with the floor and automatically close the doors simultaneously at the expiration of the door-open time. Provide microprocessor door control with circuitry to constantly monitor and automatically adjust door operation based upon velocity, position and motor current. Motor must be of the high-internal resistance type, capable of withstanding high currents resulting from stall without damage to door operator/motor. The door operator must open the car door and hoistway door simultaneously, at a speed of 76.2 cm (2.5 ft) per second. Closing speed of the doors must be 30.5 cm (1 ft) per second. Reversal of direction

of the doors from the closing to opening operation, whether initiated by obstruction of the infrared curtain or the door "OPEN" button, must be accomplished within 38 mm (1.5 in.) maximum of door movement. Emphasis is placed on obtaining quiet interlock and door operation; smooth, fast, dynamic braking for door reversals and stopping of the doors at extremes of travel.

B. Equip car doors with electric contact that prevents operation of car until doors are closed unless car is operating in leveling zone or hoistway access switch is used. Locate door contact to prevent its being tampered with from inside of car.

C. Car and hoistway doors must be manually operable in an emergency without disconnecting the power door operating equipment unless the car is outside the unlocking zone.
   1. Doors to open by power unless the elevator is in the leveling zone.
   2. Provide infrared curtain unit. The device must cause the car and hoistway doors to reverse automatically to the fully open position should the unit be actuated while the doors are closing. Unit must function when the doors are not closed, except during firefighter's operation.

D. Should the doors be prevented from closing for more than a predetermined adjustable interval of 20 to 60 seconds by operation of the curtain unit, the doors must stay open, the audio voice message and a buzzer located on the car must sound only on automatic operation. **Do not provide door nudging.**
   1. If an obstruction of the doors does not activate the photo-electric door control device and prevent the doors from closing for more than a predetermined adjustable interval of 15 to 30 seconds, the doors must reverse to the fully open position and remain open until the "Door Close" button re-establishes the closing cycle.

E. Provide door "OPEN" and "CLOSE" buttons. When the door "OPEN" button is pressed and held, the doors, if in the open position, must remain open and if the doors are closing, they must stop, reverse and re-open. Momentary pressure of the door "CLOSE" button must initiate the closing of the doors prior to the expiration of the normal door open time.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine work of other trades on which the work of this Specification depends. Report defects to the RECO or authorized representative in writing that may
affect the work of elevator contractor.

B. Examine elevator hoistway openings for plumb, level, in line and that elevator pit is proper size, waterproofed and drained with necessary access door and ladder.

C. Examine machine room for proper illumination, heating, ventilation, electrical equipment and beams are correctly located complete with access stairs and door.

D. If the Elevator Contractor requires changes in size or location of trolley beams, beam supports and trap doors, etc., to accomplish their work, changes must be justified, subject to approval of the COR and include additional cost in their bid.

E. Work required prior to the completion of the elevator installation:

1. Supply of electric feeder wires to the terminals of the elevator control panel, including circuit breaker.
2. Provide light and GFCI outlets in the elevator pit and machine room.
3. Furnish electric power for testing and adjusting elevator equipment.
4. Furnish circuit breaker panel in machine room for car and hoistway lights and receptacles.
5. Supply power for cab lighting and ventilation from an emergency power panel specified in Division 26, ELECTRICAL.
6. Machine room enclosed and protected from moisture, with self-closing, self-locking door and access stairs.
7. Provide fire extinguisher in machine room.

F. Provide to General Contractor for installation; inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

3.2 ARRANGEMENT OF EQUIPMENT

A. Arrange equipment in machine room so that major equipment components can be removed for repair or replacement without dismantling or removing other equipment in the same machine room. Locate controller near and visible to its respective hoisting machine.

3.3 WORKMANSHIP, INSTALLATION AND PROTECTION

A. Installations must be performed by Certified Elevator Mechanics and Apprentices to best possible industry standards. Details of the installation must be mechanically and electrically correct. Materials and equipment must be new and without imperfections.

B. Recesses, cutouts, slots, holes, patching, grouting, refinishing to accommodate installation of equipment must be included in the Contractor's work. All new holes in concrete must be core drilled.

C. Structural members must not be cut or altered. Work in place that is damaged or defaced must be restored equal to original new condition.

D. Finished work must be straight, plumb, level and square with smooth surfaces and lines. All machinery and equipment must be protected against dirt, water, or mechanical injury. At completion, all work must be thoroughly cleaned and delivered in perfect unblemished condition.

E. Sleeves for conduit and other small holes must project 51 mm (2 in.) above concrete slabs.

F. Exposed gears, sprockets and sheaves must be guarded from accidental contact.

3.4 CLEANING

A. After completion of installation and prior to final inspection, all equipment must be thoroughly cleaned of grease, oil, cement, plaster, dust and other debris.

B. Clean machine room and equipment.

C. Perform hoistway clean down.

D. Prior to final acceptance remove protective coverings from finished or ornamental surfaces. Clean and polish as required for type of material.

3.5 PAINTING AND FINISHING

A. All equipment, except specified as architectural finish, must be painted one coat of approved color, conforming to manufacturer's standard.

B. Hydraulic Pump Assembly must be painted with manufacturer's standard finish and color.

C. Controller, sheave, car frame and platform, counterweight, beams, rails and buffers except their machined surfaces, cams, brackets and all other uncoated ferrous metal items must be painted one factory primer coat or approved equal.

D. Stencil or apply decal floor designations not less than 101 mm (4 in.) high on hoistway doors, fascia, or walls within door restrictor areas. The color of paint used must contrast with the color of the surfaces to which it is applied.

E. Elevator pump/motor machine, controller, main line switch/shunt trip circuit breaker, bolster channel and cross head of car must be identified by 101 mm (4 in.) high numerals and letters located as directed. Numerals must contrast with surrounding color and must be stenciled or decaled.

F. Hoistway Entrances of Passenger Elevators:

1. Door panels must be given rust resistant treatment and a factory finish of one coat of baked-on primer and one factory finish coat of baked-on enamel.
2. Fascia plates, top and bottom shear guards, dust covers, hanger covers and other metalwork, including built-in or hidden work and structural metal, (except stainless steel entrance frames and surfaces to receive baked enamel finish) must be given one approved prime coat in the shop and one field coat of paint of approved color.

H. Elevator Cabs for Passenger Elevators:

1. Interior and exterior steel surfaces must be given rust resistant treatment before finish is applied.
2. Interior steel surfaces must be factory finished with one coat of paint of approved color.
3. Give exterior faces of car doors one finish coat of paint of approved color.

3.6 PRE-TESTS AND TESTS

A. Pre-test the elevators and related equipment in the presence of the COR or authorized representative for proper operation before requesting final inspection. Conduct final inspection at other than normal working hours, if required by Resident Engineer.

1. The VA must obtain the services of an Independent Qualified Elevator Inspector, ANSI/ASME QEI-1 Certified, that must witness all tests. The QEI must utilize an Elevator Acceptance Inspection Form to record the results of inspection and all testing and to identify safety code

and contract deficiencies. Specific values must be provided for all tests required by ASME A17.1, ASME A17.2 and contract documents. After completion of inspection and testing, the QEI must sign a copy of the completed form and provide it to the COR. Within 14 days of the inspection, the QEI must also prepare a formal inspection report, including all test results and deficiencies. After successful completion of inspection and testing, the QEI will complete, sign and provide a certificate of compliance provide by the VA.

2. Government must provide electric power including necessary current for starting, testing and operating machinery of each elevator.
3. Contractor must furnish the following test instruments and materials on-site and at the designated time of inspection: properly marked certified test weights, voltmeter, amp probe, thermometers, direct reading tachometer, megohm meter, vibration meter, sound meter, light meter, stopwatch and a means of two-way communication.

B. Inspection of workmanship, equipment furnished and installation for compliance with specification.

C. Full-Load Run Test: Elevators must be tested for a period of one-hour continuous run with full contract load in the car. The test run must consist of the elevator stopping at every floor, in either direction of travel, for not less than five or more than ten seconds per floor.

D. Speed Test: The actual speed of the elevator must be determined in both directions of travel with full contract load and no load in the elevator. Speed must be determined by certified tachometer. The actual measured speed of the elevator with all loads in either direction must be within three (3) percent of specified rated speed. Full speed runs must be quiet and free from vibration and sway.

E. Temperature Rise Test: The temperature rise of the pump motor must be determined during the full load test run. Temperatures must be measured using thermometers. Under these conditions, the temperature rise of the equipment must not exceed 50 degrees Centigrade above ambient temperature. Test must start when all machine room equipment is within five (5) degrees Centigrade of the ambient temperature. Other tests for heat run on motors must be performed as prescribed by the Institute of Electrical and Electronic Engineers.

F. Car Leveling Test: Elevator car leveling devices must be tested for accuracy of leveling at all floors with no load in car and with contract load in car in both directions of travel. Accuracy of floor level must be within plus or minus 3 mm (.125 in.) of level with landing floor for which the stop has been initiated regardless of load in car or direction of travel. The car leveling device must automatically correct over travel as well as under travel and must maintain the car floor within plus or minus 3 mm (.125 in.) of level with the landing floor regardless of change in load.

G. Insulation Resistance Test: The elevator's complete wiring system must be free from short circuits and ground faults and the insulation resistance of the system must be determined by use of megohm meter, at the discretion of the Elevator Inspector conducting the test.

H. Overload Devices: Test all overload current protection devices in the system at final inspection.

I. Limit Stops:

1. The position of the car when stopped by each of the normal limit switches with no load and with contract load in the car must be accurately measured.
2. Final position of the elevator relative to the terminal landings must be determined when the elevator has been stopped by the final limits. The lower limit stop must be made with contract load in the elevator. Elevator must be operated at inspection speed for both tests. Normal limit stopping devices must be inoperative for the tests.

J. Working Pressure: Verify working pressure of the hydraulic system by pressure gauge placed in the system line. Take readings with no load and full load in car.

K. Test automatic shut-off valve for proper operation.

L. Operating and Signal System: The elevator must be operated by the operating devices provided and the operation signals and automatic floor leveling must function in accordance with requirements specified. Starting, stopping and leveling must be smooth and comfortable without appreciable steps of acceleration or deceleration.

M. Performance of the Elevator supervisory system must be witnessed and approved by the elevator inspector and a representative of the Resident Engineer.

N. Evidence of malfunction in any tested system or parts of equipment that occurs during the testing must be corrected, repaired, or replaced at no additional cost to the Government and the test repeated.

O. If equipment fails test requirements and a re-inspection is required, the Contractor must be responsible for the cost of re-inspection; salaries, transportation expenses and per-diem expenses incurred by the Elevator Inspector and RE/CO or authorized representative.

3.7 INSTRUCTION OF VA PERSONNEL

A. Provide competent instruction to VA personnel regarding the operation of equipment and accessories installed under this contract, for a period equal to one eight-hour workday. Instruction must commence after completion of all work and at the time and place directed by the COR.

B. Written instructions in triplicate relative to care, adjustments and operation of all equipment and accessories must be furnished and delivered to the RE/CO or authorized representative in independently bound folders. DVD recordings will also be acceptable. Written instructions must include correct and legible wiring diagrams, nomenclature sheet of all electrical apparatus including location of each device, complete and comprehensive sequence of operation, complete replacement parts list with descriptive literature and identification and diagrams of equipment and parts. Information must also include electrical operation characteristics of all circuits, relays, timers, electronic devices and related characteristics for all rotating equipment.

C. Provide supplementary instruction for any new equipment that may become necessary because of changes, modifications or replacement of equipment or operation under requirements of paragraph entitled "Warranty of Construction".

3.8 GUARANTEE PERIOD OF SERVICE: ELEVATOR MAINTENANCE SERVICE AND INSPECTIONS

A. Provide complete maintenance service and inspections on each elevator installation for a period of one (1) year after completion and acceptance of each elevator in this specification by the Resident Engineer. This maintenance service must run concurrently with the warranty. Maintenance work must be performed by Certified Elevator Mechanics and Apprentices.

B. This contract cover full maintenance including emergency call back service, inspections and servicing the elevators listed in the schedule of elevator. The Elevator Contractor must be required to perform the following:

1. Monthly systematic examination of equipment.
2. During each maintenance visit the Elevator Contractor must clean, lubricate, adjust, repair and replace all parts as necessary to keep the equipment in like new condition and proper working order.
3. Furnishing all lubricant, cleaning materials, parts and tools necessary to perform the work required. Lubricants must be only those products recommended by the manufacturer of the equipment.
4. As required, motors, controllers, selectors, leveling devices, operating devices, switches on cars and in hoistways, hoistway doors and car doors or gate operating device, interlock contacts, guide shoes, guide rails, car door sills, hangers for doors, car doors or gates and signal system must be cleaned, lubricated and adjusted.
5. Guide rails and bottom of platforms must be cleaned every three months. Car tops and machine room floors must be cleaned monthly. Accumulated rubbish must be removed from the pits monthly. A general cleaning of the entire installation including all machine room equipment and hoistway equipment must be accomplished quarterly. Cleaning supplies and vacuum cleaner must be furnished by the Contractor.
6. Maintain the performance standards set forth in this specification.
7. The operational system must be maintained to the standards specified hereinafter including any changes or adjustments required to meet varying conditions of hospital occupancy.
8. Maintain smooth starting, stopping, running and accurate leveling.

C. Maintenance service must not include the performance of work required because if improper use, accidents and negligence for which the Elevator Contractor is not directly responsible.

D. Provide 24-hour emergency call-back service that must consist of promptly responding to calls within two hours for emergency service should a shutdown or emergency develop between regular examinations. Overtime emergency call-back service must be limited to minor

adjustments and repairs required to protect the immediate safety of the equipment and persons in and about the elevator.

E. Service and emergency personnel must report to the Resident Engineer or his authorized representative upon arrival at the hospital and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed must be given to the RE, CO, or authorized representative.

F. The Elevator Contractor must maintain a logbook in the machine room. The log must list the date and time of all bi-weekly examinations and all trouble calls. Each trouble call must be fully described including the nature of the call, necessary correction performed, or parts replaced.

G. Written “Maintenance Control Program” must be in place to maintain the equipment in compliance with ASME A17.1 Section 8.6.

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SECTION 21 13 16
DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Design, installation and testing shall be in accordance with NFPA 13.

B. The design and installation of a hydraulically calculated automatic dry-pipe sprinkler system complete and ready for operation, for those locations as shown on the contract drawings.

C. Modification of the existing dry-pipe sprinkler system as indicated on the drawings and as further required by these specifications.

1.2 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Section 07 84 00, FIRESTOPPING.

C. Section 09 91 00, PAINTING.

D. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING.

E. Section 28 31 00, FIRE DETECTION AND ALARM.

1.3 DESIGN CRITERIA

A. Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA 13.

1. Perform hydraulic calculations in accordance with NFPA 13 utilizing the Area/Density method, including all applicable design area increases.
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. Request clarification from the Government for any hazard classification not identified.
3. Dry-pipe Sprinkler System Volume:
   a. Contractor shall indicate the calculated volume of each system on the sprinkler system shop drawings.
   b. For dry-pipe sprinkler systems with volumes greater than 1893 L (500 gal) up to 2839 L (750 gal), provide a quick opening device unless water delivery time calculations indicate the quick opening devices is not required.
   c. For dry-pipe sprinkler systems with volumes greater than 2839 L (750 gal), provide calculations for water delivery time. Calculations shall demonstrate compliance with NFPA 13.
4. Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.
5. Water Supply: Base water supply on a flow test of:

a. Location: Fire Hydrant #6
b. Static pressure: 72 psi
c. Residual pressure: 68 psi
d. Flow: 1138 GPM
e. Date: 10/11/2022

Note: The Fire Suppression Contractor shall perform a flow test and verify available pressure and flow.

6. Provide seismic protection in accordance with NFPA 13. Contractor shall submit load calculations for sizing of sway bracing for systems that are required to be protected against damage from earthquakes.

1.4 SUBMITTALS

A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Prepare detailed working drawings that are signed by a NICET Level III or Level IV Sprinkler Technician or stamped by a Registered Professional Engineer licensed in the field of Fire Protection Engineering. As the Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide an index referencing the appropriate specification section. In addition to the hard copies, provide submittal items in Paragraphs 1.4(A)1 through 1.4(A)5 electronically in pdf format on a compact disc or as directed by the COR. Submittals shall include, but not be limited to, the following:

1. Qualifications:
   a. Provide a copy of the installing contractors fire sprinkler and Ohio contractor's license.
   b. Provide a copy of the NICET certification for the NICET Level III or Level IV Sprinkler Technician who prepared and signed the detailed working drawings unless the drawings are stamped by a Registered Professional Engineer licensed in the field of Fire Protection Engineering.
   c. Provide documentation showing that the installer has been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.
2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to the Plans and Calculations chapter of NFPA 13. Drawings shall include graphical scales that allow the user to determine lengths when the drawings are reduced in size. Include a plan showing the piping to the water supply test location.
3. Manufacturer's Data Sheets: Provide data sheets for all materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets.

Where data sheets describe items in addition to those proposed to be used for the system, clearly identify the proposed items on the sheet.

4. Calculation Sheets:
   a. Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of the Plans and Calculations chapter of NFPA 13.
   b. For dry-pipe sprinkler systems with volumes more than 2838 L (750 gal), submit calculations for dry-pipe system water delivery time in accordance with NFPA 13.
   c. Submit calculations of loads for sizing of sway bracing in accordance with NFPA 13.
5. Valve Charts: Provide a valve chart that identifies the location of each control valve. Coordinate nomenclature and identification of control valves with COR. Where existing nomenclature does not exist, the chart shall include no less than the following: Tag ID No., Valve Size, Service (control valve, main drain, aux. drain, inspectors test valve, etc.), and Location.
6. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. In addition, submittals shall include, but not be limited to, the following:
   a. A complete set of as-built drawings showing the installed system with the specific interconnections between the system switches and the fire alarm equipment. Provide a complete set in the formats as follows. Submit items 2 and 3 below on a compact disc or as directed by the COR.
      1) One full size (or size as directed by the COR) printed copy.
      2) One complete set in electronic pdf format.
      3) One complete set in AutoCAD format or a format as directed by the COR.
   b. Material and Testing Certificate: Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a completed Material and Testing Certificate as indicated in NFPA 13. Certificates shall be provided to document all parts of the installation.
   c. Operations and Maintenance Manuals that include step-by-step procedures required for system startup, operation, shutdown, and routine maintenance and testing. The manuals shall include the manufacturer's name, model number, parts list, and tools that should be kept in stock by the owner for routine maintenance, including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization, including address and telephone number, for each item of equipment.

d. One paper copy of the Material and Testing Certificates and the Operations and Maintenance Manuals above shall be provided in a binder. In addition, these materials shall be provided in pdf format on a compact disc or as directed by the COR.

e. Provide one additional copy of the Operations and Maintenance Manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser or as directed by the COR.

1.5 QUALITY ASSURANCE

A. Installer Reliability: The installer shall possess a valid State of 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 ..... Installation of Sprinkler Systems

25 ..... Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

101 ..... Life Safety Code

170 ..... 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 GENERAL

Dry-pipe sprinkler systems shall comply with the requirements of NFPA 13.

2.2 PIPING & FITTINGS

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.

2.3 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:
   1. Shall be a manually operated outside stem and yoke (OS&Y) type.

C. Dry-pipe Valve:
   1. Shall be a latching differential type.
   2. Shall be complete with trim piping, valves, fittings, pressure gauges, priming water fill cup, velocity drip check, drip cup, and other ancillary components as required for proper operation.
   3. For dry-pipe sprinkler systems with volumes more than 1893 L (500 gal), provide a quick opening device unless water delivery time calculations have proven no quick opening device is required.
   4. Shall be capable of external reset.

D. Check Valve:
   1. Shall be of the swing type with a flanged cast iron body and flanged inspection plate.

E. Automatic Ball Drips: Cast brass 20 mm (3/4 inch) in-line automatic ball drip with both ends threaded with iron pipe threads.

F. Backflow Preventer: Provide backflow preventer in accordance with Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING. Provide means to forward flow test the backflow preventer in accordance with NFPA 13.

2.4 SPRINKLERS

A. All sprinklers shall be FM approved. All sprinklers shall be either upright type, dry pendent type, or dry sidewall type. Provide FM Approved quick response sprinklers in all areas, except that standard response sprinklers shall be provided in freezers, refrigerators, elevator hoistways, elevator machine rooms, and generator rooms.

B. Temperature Ratings: In accordance with NFPA 13 except that sprinklers in elevator shafts and elevator machine rooms shall be no less than intermediate temperature rated and sprinklers in generator rooms shall be no less than high temperature rated.

C. Provide sprinkler guards in accordance with NFPA 13 and when the elevation of the head is less than 7 feet 6 inches above finished floor. The sprinkler guard shall be listed or approved for use with the corresponding sprinkler.

2.5 SPRINKLER CABINET

A. Provide the required number of sprinkler heads of all ratings and types installed, and a sprinkler wrench for each type of sprinkler in accordance with NFPA 13. Locate adjacent to the riser, in existing sprinkler cabinet.

B. Provide a list of sprinklers installed in the property in the cabinet. The list shall include the following:

1. Manufacturer, model, orifice, deflector type, thermal sensitivity, and pressure for each type of sprinkler in the cabinet.
2. General description of where each sprinkler is used.
3. Quantity of each type present in the cabinet.
4. Issue or revision date of list.

2.6 SPRINKLER SYSTEM SIGNAGE

A. Rigid plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Sprinkler system signage shall be attached to the valve or piping with chain.

2.7 SWITCHES

A. OS&Y Valve Supervisory Switches shall be in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, 13 mm (1/2 inch) conduit entrance and necessary facilities for attachment to the valves. Provide two SPDT switches rated at 2.5 amps at 24 VDC.

B. Alarm Pressure Switches: Activation by any flow of water equal to or in excess of the discharge from one sprinkler. The alarm pressure switch shall be UL Listed or Factory Mutual Approved for the application in which it is used. Activation of the alarm pressure switch shall cause an alarm on the fire alarm system control unit.

C. High/Low Pressure Supervisory Switches: The pressure switch shall be UL Listed or FM Approved and contain two single pole double throw contacts. Each switch shall be adjustable from 70 to 414 kPa (10 to 60 psi). The low pressure switch shall supervise pressure in the system and shall be set to activate at 70 kPa (10 psi) above the dry-pipe valve trip point pressure. The high pressure switch shall supervise pressure in the system and shall be set to activate at 70 kPa (10 psi) above the normal dry-pipe supervisory pressure. Activation of either high or low pressure switch shall cause a supervisory alarm on the fire alarm system control unit.

2.8 GAUGES

A. Provide gauges as required by NFPA 13. Provide gauges where the normal pressure of the system is at the midrange of the gauge.

2.9 PIPE HANGERS, SUPPORTS AND RESTRAINT OF SYSTEM PIPING

A. Pipe hangers, supports, and restraint of system piping shall be in accordance with NFPA 13.

2.10 WALL, FLOOR AND CEILING PLATES

A. Provide chrome plated steel escutcheon plates.

2.11 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. Conceal piping in spaces that have finished ceilings. 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, and seismic bracing shall be installed accordance with NFPA 13.

C. Welding: Conform to the requirements and recommendations of NFPA 13.

D. Pitching of Pipe: Conform to the requirements of NFPA 13.

E. 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. Do not provide a direct drain connection to sewer system or discharge into sinks.

F. Supervisory Switches: Provide supervisory switches for sprinkler control valves to monitor closure of the valve and for high and low system supervisory air/nitrogen pressure to monitor abnormal system pressures.

G. Pressure Alarm Switches: Install alarm pressure switches in easily accessible locations.

H. Inspector's Test Connection: Install and supply in conformance with NFPA 13, and discharge to the exterior of the building. Locate test connection in an area not susceptible to mechanical damage. For dry-pipe sprinkler systems more than 2800 L (750 gal), provide the number of equivalent sprinkler outlets as calculated for water delivery time in accordance with NFPA 13.

I. Affix cutout disks, which are created by cutting holes in the walls of pipe for non-threaded pipe connections, to the respective pipe connection near to the pipe from where they were cut.

J. Provide escutcheon plates for exposed piping passing through walls, floors or ceilings.

K. Clearances: For systems requiring seismic protection, piping that passes through floors or walls shall have penetrations sized 50 mm (2 inches) nominally larger than the penetrating pipe for pipe sizes 25 mm (1 inch) to 90 mm (3 ½ inches) and 100 mm (4 inches) nominally larger for penetrating pipe sizes 100 mm (4 inches) and larger.

L. 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 around penetrations. Seal penetrations of walls, floors and ceilings of other types of construction, in accordance with Section 07 84 00, FIRESTOPPING.

M. Firestopping shall be provided for all penetrations of fire resistance rated construction. Firestopping shall comply with Section 07 84 00, FIRESTOPPING.

N. 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.

O. Locate sprinkler cabinet adjacent to the dry-pipe sprinkler system riser or as directed by COR.

P. Sprinkler System Signage: Provide rigid sprinkler system signage in accordance with NFPA 13 and NFPA 25. Sprinkler system signage shall include, but not limited to, the following:

1. Identification Signs:
   a. Provide signage for each control valve, drain valve, sprinkler cabinet, and inspector's test.
   b. Provide valve tags for each operable valve. Coordinate nomenclature and identification of operable valves with COR. Where existing nomenclature does not exist, the Tag Identification shall include no less than the following: (FP-B-F/SZ-#) Fire Protection, Building Number, Floor Number/Smoke Zone (if applicable), and Valve Number. (E.g., FP-500-1E-001) Fire Protection, Building 500, First Floor East, Number 001.)
2. Instruction/Information Signs:
   a. Provide signage for each control valve to indicate valve function and to indicate what system is being controlled.
   b. Provide signage indicating the number and location of low point drains.
3. Hydraulic Placards:

a. Provide signage indicating hydraulic design information. The placard shall include location of the design area, discharge densities, required flow and residual pressure at the base of riser, occupancy classification, hose stream allowance, flow test information, and installing contractor. Locate hydraulic placard information signs at each dry-pipe valve.

Q. 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.

R. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the Contracting Officer Representative. Contractor shall develop an interim fire protection program where interruptions involve in 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 tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed. Manually demonstrate nitrogen concentration in dry-pipe sprinkler system piping is at least 98%. Hydrostatically test system, including the fire department connections, pneumatically test system, test air compressor fill time to operating pressure within 30 minutes, and trip test system as specified in NFPA 13, in the presence of the Contracting Officers Representative (COR) or their designated representative. For dry-pipe sprinkler systems with a quick-opening device, the system shall be trip tested with the quick-opening device functioning and with the quick-opening device disabled. Record the time to water delivery for each test. Demonstrate pitch of pipe is in compliance with NFPA 13.

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 inspection and testing. Include the operation of all features of the systems under normal operations in test. At the conclusion of final inspection and testing, blow out dry-pipe system piping using compressed air. Verify piping is fully drained, including low point drains.

C. Post-Final Inspection: One month after final inspection and testing, the contractor shall manually verify that the system piping has a nitrogen concentration of at least 98%. Advise COR to schedule post-final inspection.

D. Final Contractual Acceptance: Final contractual acceptance will be given after successful completion of the final inspection and testing and post-final inspection. The warranty period shall begin after final contractual acceptance.

3.3 INSTRUCTIONS

A. Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system on the dates requested by the COR.

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SECTION 22 05 11
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section will apply to all sections of Division 22.

B. Definitions:

1. Exposed: Piping and equipment exposed to view in finished rooms.
2. Exterior: Piping and equipment exposed to weather be it temperature, humidity, precipitation, wind, or solar radiation.

C. Abbreviations/Acronyms:

1. ABS: Acrylonitrile Butadiene Styrene
2. AC: Alternating Current
3. ACR: Air Conditioning and Refrigeration
4. A/E: Architect/Engineer
5. AFF: Above Finish Floor
6. AFG: Above Finish Grade
7. AI: Analog Input
8. AISI: American Iron and Steel Institute
9. AO: Analog Output
10. ASHRAE: American Society of Heating Refrigeration, Air Conditioning Engineers
11. ASJ: All Service Jacket
12. ASME: American Society of Mechanical Engineers
13. ASPE: American Society of Plumbing Engineers
14. AWG: American Wire Gauge
15. BACnet: Building Automation and Control Network
16. BAg: Silver-Copper-Zinc Brazing Alloy
17. BAS: Building Automation System
18. BCuP: Silver-Copper-Phosphorus Brazing Alloy
19. bhp: Brake Horsepower
20. Btu: British Thermal Unit
21. Btu/h: British Thermal Unit per Hour
22. BSG: Borosilicate Glass Pipe
23. C: Celsius
24. CA: Compressed Air
25. CD: Compact Disk
26. CDA: Copper Development Association
27. CGA: Compressed Gas Association

28. CFM: Cubic Feet per Minute
29. CI: Cast Iron
30. CLR: Color
31. CO: Contracting Officer
32. COR: Contracting Officer's Representative
33. CPVC: Chlorinated Polyvinyl Chloride
34. CR: Chloroprene
35. CRS: Corrosion Resistant Steel
36. CWP: Cold Working Pressure
37. CxA: Commissioning Agent
38. dB: Decibels
39. db(A): Decibels (A weighted)
40. DCW: Domestic Cold Water
41. DDC: Direct Digital Control
42. DFU: Drainage Fixture Units
43. DHW: Domestic Hot Water
44. DHWR: Domestic Hot Water Return
45. DHWS: Domestic How Water Supply
46. DI: Digital Input
47. DI: Deionized Water
48. DISS: Diameter Index Safety System
49. DN: Diameter Nominal
50. DO: Digital Output
51. DOE: Department of Energy
52. DVD: Digital Video Disc
53. DWG: Drawing
54. DWH: Domestic Water Heater
55. DWS: Domestic Water Supply
56. DWV: Drainage, Waste and Vent
57. ECC: Engineering Control Center
58. EL: Elevation
59. EMCS: Energy Monitoring and Control System
60. EPA: Environmental Protection Agency
61. EPACT: Energy Policy Act
62. EPDM: Ethylene Propylene Diene Monomer
63. EPT: Ethylene Propylene Terpolymer
64. ETO: Ethylene Oxide

65. F: Fahrenheit
66. FAR: Federal Acquisition Regulations
67. FD: Floor Drain
68. FDC: Fire Department (Hose) Connection
69. FED: Federal
70. FG: Fiberglass
71. FNPT: Female National Pipe Thread
72. FOR: Fuel Oil Return
73. FOS: Fuel Oil Supply
74. FOV: Fuel Oil Vent
75. FPM: Fluoroelastomer Polymer
76. FSK: Foil-Scrim-Kraft Facing
77. FSS: VA Construction & Facilities Management, Facility Standards Service
78. FU: Fixture Units
79. GAL: Gallon
80. GCO: Grade Cleanouts
81. GPD: Gallons per Day
82. GPH: Gallons per Hour
83. GPM: Gallons per Minute
84. HDPE: High Density Polyethylene
85. HEFP: Healthcare Environment and Facilities Program (replacement for OCAMES)
86. HEX: Heat Exchanger
87. Hg: Mercury
88. HOA: Hands-Off-Automatic
89. HP: Horsepower
90. HVE: High Volume Evacuation
91. Hz: Hertz
92. ID: Inside Diameter
93. IE: Invert Elevation
94. INV: Invert
95. IPC: International Plumbing Code
96. IPS: Iron Pipe Size
97. IW: Indirect Waste
98. IWH: Instantaneous Water Heater
99. Kg: Kilogram
100. kPa: Kilopascal
101. KW: Kilowatt

102. KWH: Kilowatt Hour
103. lb: Pound
104. lbs/hr: Pounds per Hour
105. LNG: Liquid Natural Gas
106. L/min: Liters per Minute
107. LOX: Liquid Oxygen
108. L/s: Liters per Second
109. m: Meter
110. MA: Medical Air
111. MAWP: Maximum Allowable Working Pressure
112. MAX: Maximum
113. MBH: 1000 Btu per Hour
114. MED: Medical
115. MER: Mechanical Equipment Room
116. MFG: Manufacturer
117. mg: Milligram
118. mg/L: Milligrams per Liter
119. ml: Milliliter
120. mm: Millimeter
121. MIN: Minimum
122. MV: Medical Vacuum
123. N2: Nitrogen
124. N20: Nitrogen Oxide
125. NC: Normally Closed
126. NF: Oil Free Dry (Nitrogen)
127. NG: Natural Gas
128. NIC: Not in Contract
129. NO: Normally Open
130. NOM: Nominal
131. NPTF: National Pipe Thread Female
132. NPS: Nominal Pipe Size
133. NPT: Nominal Pipe Thread
134. NTS: Not to Scale
135. O2: Oxygen
136. OC: On Center
137. OD: Outside Diameter
138. OSD: Open Sight Drain

139. OS&Y: Outside Stem and Yoke
140. PA: Pascal
141. PBPU: Prefabricated Bedside Patient Units
142. PD: Pressure Drop or Difference
143. PDI: Plumbing and Drainage Institute
144. PH: Power of Hydrogen
145. PID: Proportional-Integral-Differential
146. PLC: Programmable Logic Controllers
147. PP: Polypropylene
148. ppb: Parts per Billion
149. ppm: Parts per Million
150. PSI: Pounds per Square Inch
151. PSIA: Pounds per Square Inch Atmosphere
152. PSIG: Pounds per Square Inch Gauge
153. PTFE: Polytetrafluoroethylene
154. PVC: Polyvinyl Chloride
155. PVDF: Polyvinylidene Fluoride
156. RAD: Radians
157. RO: Reverse Osmosis
158. RPM: Revolutions Per Minute
159. RTD: Resistance Temperature Detectors
160. RTRP: Reinforced Thermosetting Resin Pipe
161. SAN: Sanitary Sewer
162. SCFM: Standard Cubic Feet per Minute
163. SDI: Silt Density Index
164. SMACNA: Sheet Metal and Air Conditioning Contractors National Association
165. SPEC: Specification
166. SPS: Sterile Processing Services
167. SQFT/SF: Square Feet
168. SS: Stainless Steel
169. STD: Standard
170. SUS: Saybolt Universal Second
171. SWP: Steam Working Pressure
172. TD: Temperature Difference
173. TDH: Total Dynamic Head
174. TEFC: Totally Enclosed Fan-Cooled
175. TEMP: Temperature

176. TFE: Tetrafluoroethylene
177. THERM: 100,000 Btu
178. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
179. THWN: Thermoplastic Heat & Water Resistant Nylon Coated Wire
180. TIL: Technical Information Library http//www.cfm.va.gov/til/indes.asp
181. T/P: Temperature and Pressure
182. TYP: Typical
183. USDA: U.S. Department of Agriculture
184. V: Vent
185. V: Volt
186. VA: Veterans Administration
187. VA CFM: VA Construction & Facilities Management
188. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
189. VAC: Vacuum
190. VAC: Voltage in Alternating Current
191. VAMC: Veterans Administration Medical Center
192. VHA OCAMES: This has been replaced by HEFP.
193. VSD: Variable Speed Drive
194. VTR: Vent through Roof
195. W: Waste
196. WAGD: Waste Anesthesia Gas Disposal
197. WC: Water Closet
198. WG: Water Gauge
199. WOG: Water, Oil, Gas
200. WPD: Water Pressure Drop
201. WSFU: Water Supply Fixture Units

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
D. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
E. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
F. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete and Grout.
G. Section 05 31 00, STEEL DECKING: Building Components for Attachment of Hangers.
H. Section 05 36 00, COMPOSITE METAL DECKING: Building Components for Attachment of Hangers.
I. Section 07 60 00, FLASHING AND SHEET METAL: Flashing for Wall and Roof Penetrations.

J. Section 07 84 00, FIRESTOPPING.

K. Section 07 92 00, JOINT SEALANTS.

L. Section 09 91 00, PAINTING.

M. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

N. Section 22 07 11, PLUMBING INSULATION.

O. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

P. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

Q. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

R. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below will form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):

B31.1-2013 ..... Power Piping

ASME Boiler and Pressure Vessel Code -

BPVC Section IX-2019.....Welding, Brazing, and Fusing Qualifications

C. American Society for Testing and Materials (ASTM):

A36/A36M-2019 ..... Standard Specification for Carbon Structural Steel

A575-96(2013)e1 ..... Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

E84-2013a ..... Standard Test Method for Surface Burning Characteristics of Building Materials

E119-2012a ..... Standard Test Methods for Fire Tests of Building Construction and Materials

D. International Code Council, (ICC):

IBC-2018 ..... International Building Code

IPC-2018 ..... International Plumbing Code

E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:

SP-58-2018..... Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

F. Military Specifications (MIL):

P-21035B..... Paint High Zinc Dust Content, Galvanizing Repair (Metric)

G. National Electrical Manufacturers Association (NEMA):

MG 1-2016..... Motors and Generators

H. National Fire Protection Association (NFPA):

51B-2019 ..... Standard for Fire Prevention During Welding, Cutting and Other Hot Work

54-2018 ..... National Fuel Gas Code

70-2020 ..... National Electrical Code (NEC)

99-2018 ..... Healthcare Facilities Code

I. NSF International (NSF):

5-2019 ..... Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment

14-2019 ..... Plastic Piping System Components and Related Materials

61-2019 ..... Drinking Water System Components – Health Effects

372-2016 ..... Drinking Water System Components – Lead Content

J. Department of Veterans Affairs (VA):

PG-18-102023 ..... Plumbing Design Manual

PG-18-13-2017(R18) ..... Barrier Free Design Guide

1.4 SUBMITTALS

A. Submittals, including number of required copies, will be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section will be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.

C. If the project is phased, contractors will submit complete phasing plan/schedule with manpower levels prior to commencing work. The phasing plan will be detailed enough to provide milestones in the process that can be verified.

D. Contractor will make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, are accessable from the floor or permanent work platform. It is the Contractor's responsibility to ensure all submittals meet the VA specifications and requirements and it is assumed by the VA that all submittals do meet the VA specifications unless the Contractor has requested a variance in writing and approved by COR prior to the submittal. If at any time during the project, it is found that any item does not meet the VA specifications and there was no variance approval the Contractor will correct at no additional cost or time to the Government even if a submittal was approved.

E. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical will be the Contractor's responsibility to design, supply, and

install at no additional cost or time to the Government. VA approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

F. Prior to submitting shop drawings for approval, Contractor will certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

G. Submittals and shop drawings for interdependent items, containing applicable descriptive information, will be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.

H. Manufacturer's Literature and Data including: Manufacturer’s literature will be submitted under the pertinent section rather than under this section.
   1. Electric motor data and variable speed drive data will be submitted with the driven equipment.
   2. Equipment and materials identification.
   3. Firestopping materials.
   4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
   5. Wall, floor, and ceiling plates.

I. Coordination/Shop Drawings:
   1. Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas.
   2. The coordination/shop drawings will include plan views, elevations and sections of all systems and will be on a scale of not less than 1:32 (3/8-inch equal to 1 foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings will clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed coordination/shop drawings of all piping and duct systems. The drawings should include all lockout/tagout points for all energy/hazard sources for each piece of equipment. Coordinate lockout/tagout procedures and practices with local VA requirements.
   3. Do not install equipment foundations, equipment or piping until coordination/shop drawings have been approved.
   4. In addition, for plumbing systems, provide details of the following:
      a. Mechanical equipment rooms.
      b. Hangers, inserts, supports, and bracing.
      c. Pipe sleeves.

d. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

J. Rigging Plan: Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan will include the path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.

K. Plumbing Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   a. Include complete list indicating all components of the systems.
   b. Include complete diagrams of the internal wiring for each item of equipment.
   c. Diagrams will have their terminals identified to facilitate installation, operation, and maintenance.
3. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size, and style, and distinguished whether of multiple belt sets.

1.5 QUALITY ASSURANCE

A. Mechanical, electrical, and associated systems will be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems will be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel will be experienced and qualified specialists in industrial and institutional plumbing.

B. Products Criteria:

1. Standard Products: Material and equipment will be the standard products of a manufacturer regularly engaged in the manufacture, supply, and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls, instruments, computer workstation, will be the current generation of technology and basic design that has a proven satisfactory service record of at least 5 years.
2. Equipment Service: There will be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations will come to the site and provide acceptable service to restore operations within 4 hours of receipt of notification by phone, e-mail, or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, compressors, water

heaters, critical instrumentation, computer workstation and programming will be submitted for project record and inserted into the operations and maintenance manual.

3. All items furnished will be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 22 will conform to the referenced codes and standards by the specifications. Local codes and amendments enforced by the local code official will be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code will apply. Any conflicts will be brought to the attention of the Contracting Officers Representative (COR).
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units will be of the same manufacturer and model number, or if different models are required, they will be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit will be the responsibility of the manufacturer of the completed assembly.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark will be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
8. Asbestos products or equipment or materials containing asbestos is prohibited.
9. Bio-Based Materials: For products designated by the USDA's bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

C. Welding: Before any welding is performed, Contractor will submit a certificate certifying that welders comply with the following requirements:
   1. Qualify welding processes and operators for piping according to ASME BPVC, Section IX, "Welding and Brazing Qualifications". Provide proof of current certification to CO.
   2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
   3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
   4. All welds will be stamped according to the provisions of the AWS or ASME as required herein and by the association code.

D. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations will be furnished to the COR prior to installation.

Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

E. Execution (Installation, Construction) Quality:
   1. All items will be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents will be referred to the COR for resolution. Printed copies or electronic files of manufacturer’s installation instructions will be provided to the COR at least 10 working days prior to commencing installation of any item.
   2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, will be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to COR for resolution. Failure of the Contractor to resolve or call attention to any discrepancies or deficiencies to the COR will result in the Contractor correcting at no additional cost or time to the Government.
   3. Complete layout drawings will be required by Paragraph, SUBMITTALS. Construction work will not start on any system until the layout drawings have been approved by VA.
   4. Installer Qualifications: Installer will be licensed and will provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade.
   5. Workmanship/craftsmanship will be of the highest quality and standards. The VA reserves the right to reject any work based on poor quality of workmanship this work will be removed and done again at no additional cost or time to the Government.

F. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

G. Guaranty: Warranty of Construction, FAR clause 52.246-21.

H. Plumbing Systems: IPC, International Plumbing Code. Unless otherwise required herein, perform plumbing work in accordance with the latest version of the IPC. For IPC codes referenced in the contract documents, advisory provisions will be considered mandatory, the word “should” will be interpreted as “will”. Reference to the “code official” or “owner/Government” will be interpreted to mean the COR.

I. Cleanliness of Piping and Equipment Systems:
   1. Care will be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading, and welding of piping will be removed.

2. Piping systems will be flushed, blown, or pigged as necessary to deliver clean systems.
3. The interior of all tanks will be cleaned prior to delivery and beneficial use by the Government. All piping will be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets will be flushed of debris prior to final acceptance.
4. Contractor will be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:
1. Equipment and material placed on the job site will remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.
2. Damaged equipment will be replaced with an identical unit as determined and directed by the COR. Such replacement will be at no additional cost or additional time to the Government.
3. Interiors of new equipment and piping systems will be protected against entry of foreign matter. Both inside and outside will be cleaned before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor will be under the custody and responsibility of the Contractor and will be protected as new work.

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions will be in electronic version on CD or DVD inserted into a three–ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation will be included in the operation and maintenance manual. The operations and maintenance manual will include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices will be included. A List of recommended spare parts (manufacturer, model number, and quantity) will be furnished. Information explaining any special knowledge or tools the Government will be required to employ will be inserted into the As-Built documentation.

C. The installing Contractor will maintain as-built drawings of each completed phase for verification; and will provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it will

not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:

1. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.
2. As-built drawings are to be provided, with a copy of them on AutoCAD provided on CD or DVD. The CAD drawings will use multiple line layers with a separate individual layer for each system.
3. As-built drawings are to be provided, with a copy of them in three-dimensional Building Information Modeling (BIM) software provided on CD or DVD.

D. The as-built drawings will indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation will be provided to COR 21 working days prior to submitting the request for final inspection. The documentation will include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results will contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results will include all readings, including 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.

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 will submit a complete detailed phasing plan/schedule with manpower levels prior to commencing work. The phasing plan will be detailed enough to provide milestones in the process that can be verified.

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. Steel pipe will contain a minimum of 25 percent recycled content.

B. Material or equipment containing a weighted average of greater than 0.25 percent lead will not be used in any potable water system intended for human consumption and will be certified in accordance with NSF 61 or NSF 372.

C. In-line devices such as water meters, building valves, check valves, stops, valves, fittings, tanks and backflow preventers will comply with NSF 61 and NSF 372.

D. 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 shall meet requirements of NSF 61 and NSF 372.

2.2 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components will be maximized to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others will assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike will be products of a single manufacturer.
3. Components will be compatible with each other and with the total assembly for intended service.
4. Contractor will guarantee performance of assemblies of components and will repair or replace elements of the assemblies to deliver specified performance of the complete assembly at no additional cost or time to the Government.

C. Components of equipment will bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, will be the same make and model.

2.3 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed will be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.4 SAFETY GUARDS

A. Pump shafts and couplings will be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material will be minimum 16-gauge sheet steel; ends will be braked and drilled and attached to pump base with minimum of four 8 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

B. All Equipment will have moving parts protected from personal injury.

2.5 LIFTING ATTACHMENTS

A. Equipment will be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments will withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.6 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

A. All material and equipment furnished, and installation methods used will conform to the requirements of Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT; Section 26 29 11, MOTOR CONTROLLERS; and, Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems will be provided. Premium efficient motors will be provided. Unless otherwise specified for a particular application, electric motors will have the following requirements.

B. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 at no additional cost or time to the Government.
2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices will be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications will be modified as follows:
   a. Wiring material located where temperatures can exceed 71° C (160° F) will be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers and water heaters.
   b. Other wiring at boilers and water heaters, and to control panels, will be NFPA 70 designation THWN.
   c. Shielded conductors or wiring in separate conduits for all instrumentation and control systems will be provided where recommended by manufacturer of equipment.
4. Motor sizes will be selected so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps will be sized for non-overloading at all points on the pump performance curves.

5. Motors utilized with variable frequency drives will be rated “inverter-ready” per NEMA Standard, MG1.

C. Motor Efficiency and Power Factor: All motors, when specified as “high efficiency or Premium Efficiency” by the project specifications on driven equipment, will conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT, with no consideration of annual service hours. Motor manufacturers generally define these efficiency requirements as “NEMA premium efficient” and the requirements generally exceed those of the Energy Policy Act (EPACT), revised 2005. Motors not specified as “high efficiency or premium efficient” will comply with EPACT.

D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal pumps may be split phase or permanent split capacitor (PSC).

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor will have two separate windings. A time delay (20 seconds minimum) relay will be provided for switching from high to low speed.

F. Rating: Rating will be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on drawings; maximum horsepower in normal operation will not exceed nameplate rating without service factor.

G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame will be measured at the time of final inspection.

2.7 VARIABLE SPEED MOTOR CONTROLLERS

A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, MOTOR CONTROLLERS for specifications.

B. The combination of controller and motor will be provided by the respective pump manufacturer and will be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. pumps, will be product of a single manufacturer.

C. Motors will be premium efficient type, “invertor duty”, and be approved by the motor controller manufacturer. The controller-motor combination will be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor sheaves will be fixed pitch.

D. Controller will not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, nor will be affected from other devices on the AC power system.

2.8 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. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 7 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING will be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, etc. will be identified.

C. Control Items: All temperature, pressure, and controllers will be labeled and the component's function identified. Identify and label each item as they appear on the control diagrams.

D. Valve Tags and Lists:

1. Plumbing: All valves will be provided with valve tags and listed on a valve list (Fixture stops not included).
2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gauge, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Valve lists will be created using a word processing program and printed on plastic coated cards. The plastic-coated valve list card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) will show valve tag number, valve function and area of control for each service or system. The valve list will be in a punched 3-ring binder notebook. An additional copy of the valve list will be mounted in picture frames for mounting to a wall. COR will instruct Contractor where frames will be mounted.
4. A detailed plan for each floor of the building indicating the location and valve number for each valve will be provided in the 3-ring binder notebook. Each valve location will be identified with a color-coded sticker or thumb tack in ceiling or access door.

2.9 FIRESTOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke, and gases where penetrations occur for piping. Refer to Section 22 07 11, PLUMBING INSULATION, for pipe insulation.

2.10 GALVANIZED REPAIR COMPOUND

A. Mil. Spec. DOD-P-21035B, paint.

2.11 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC) requirements, or the following paragraphs of this Section will be stamped and signed by a professional engineer registered in the state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) will be submitted for approval of the COR in all cases. See the above specifications for lateral force design requirements.

B. Type Numbers Specified: For materials, design, manufacture, selection, application, and installation refer to MSS SP-58. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.

C. For Attachment to Concrete Construction:
   1. Concrete insert: Type 18, MSS SP-58.
   2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
   3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.

D. For Attachment to Steel Construction: MSS SP-58.
   1. Welded attachment: Type 22.
   2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.

E. For Attachment to Wood Construction: Wood screws or lag bolts.

F. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles will provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

G. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 43 mm by 43 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gauge), designed to accept special spring held, hardened steel nuts.
   1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
   2. Guide individual pipes on the horizontal member of every other trapeze hanger with 8 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

H. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.
   1. General Types (MSS SP-58):
      a. Standard clevis hanger: Type 1; provide locknut.
      b. Riser clamps: Type 8.
      c. Wall brackets: Types 31, 32 or 33.
      d. Roller supports: Type 41, 43, 44 and 46.
      e. Saddle support: Type 36, 37 or 38.

f. Turnbuckle: Types 13 or 15.
g. U-bolt clamp: Type 24.
h. Copper Tube:
1) Hangers, clamps, and other support material in contact with tubing will be painted with copper colored epoxy paint, copper-coated, plastic coated or taped with isolation tape to prevent electrolysis.
2) For vertical runs use epoxy painted, copper-coated or plastic coated riser clamps.
3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
i. Spring hangers are required on all plumbing system pumps one horsepower and greater.

2. Plumbing Piping (Other Than General Types):
a. Horizontal piping: Type 1, 5, 7, 9, and 10.
b. Chrome plated piping: Chrome plated supports.
c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gauge) minimum.

I. Pre-insulated Calcium Silicate Shields:
1. Provide 360-degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.
2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
3. Shield thickness will match the pipe insulation.
4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
a. Shields for supporting cold water will have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal.
b. The insulated calcium silicate shield will support the maximum allowable water filled span indicated in MSS SP-58. To support the load, the shields will have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.
5. Shields may be used on steel clevis hanger type supports, trapeze hangers, roller supports or flat surfaces.

2.12 PIPE PENETRATIONS

A. Pipe penetration sleeves will be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.

B. Pipe penetration sleeve materials will comply with all firestopping requirements for each penetration.

C. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

D. Penetrations are prohibited through beams or ribs, but may be installed in concrete beam flanges, with structural engineer prior approval. Any deviation from these requirements shall receive prior approval of COR.

E. Sheet metal, plastic, or moisture resistant fiber sleeves will be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

F. Cast iron or zinc coated pipe sleeves will be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe will be made watertight with a modular or link rubber seal. The link seal will be applied at both ends of the sleeve.

G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves will be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve will be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves will be connected with a floor plate.

H. Brass Pipe Sleeves will be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve will be connected with a floor plate.

I. Sleeve clearance through floors, walls, partitions, and beam flanges will be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation will be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings will be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water, and gases.

J. Sealant and Adhesives: Will be as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials will be utilized when possible. Pipe passing through roof will be installed through a 4.9 kg per square meter copper flashing with an integral skirt or flange. Skirt or flange will extend not less than 200 mm (8 inches) from the pipe and set in a solid coating of bituminous cement.

Extend flashing a minimum of 250 mm (10 inches) up the pipe. Pipe passing through a waterproofing membrane will be provided with a clamping flange. The annular space between the sleeve and pipe will be sealed watertight.

2.13 TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the COR.

D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials will be utilized when possible.

2.14 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 75 mm (3 inch) pipe, 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls, and ceilings in exposed locations, in finished areas only. Wall plates will be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint will be provided in spaces where brass or steel pipe sleeves are specified.

2.15 ASBESTOS

A. Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions will be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment will be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings will be prepared to coordinate proper location and personnel access of all facilities. The drawings will be submitted for review.

B. Manufacturer's published recommendations will be followed for installation methods not otherwise specified.

C. Operating Personnel Access and Observation Provisions: All equipment and systems will be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, all equipment items, valves, backflow

preventers, filters, strainers, transmitters, sensors, meters and control devices. All gauges and indicators will be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown in the drawings will not be changed nor reduced.

D. Structural systems necessary for pipe and equipment support will be coordinated to permit proper installation.

E. Location of pipe sleeves, trenches and chases will be accurately coordinated with equipment and piping locations.

F. Cutting Holes:

1. Holes will be located to avoid interference with structural members such as beams or grade beams. Holes will be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter will be referred to COR for approval.
2. Waterproof membrane will not be penetrated. Pipe floor penetration block outs will be provided outside the extents of the waterproof membrane.
3. Holes through concrete and masonry will be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COR where working area space is limited.

G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other services are not shown but must be provided.

H. Protection and Cleaning:

1. Equipment and materials will be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, will be replaced at no additional cost or time to the Government.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures will be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials, and equipment.

I. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psig) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, will be used for all pad or floor mounted equipment.

J. Gauges, thermometers, valves, and other devices will be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gauges will be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing will not require dismantling adjacent equipment or pipe work.

K. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but will be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, alarms, instruments, and computer workstations. Comply with NFPA 70.

L. Domestic cold and hot water systems interface with the HVAC control system for the temperature, pressure, and flow monitoring requirements to mitigate legionella. See the HVAC control points list and Section 23 09 23, DIRECT DIGITAL CONTROL SYSTEM FOR HVAC.

M. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations, and restoration of existing building(s).
2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.

N. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons will be sealed with plumbers' putty.

O. Switchgear Drip Protection: Every effort will be made to eliminate the installation of pipe above data equipment, and electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Drain valve will be provided in low point of casement pipe.

P. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment will be removed and reinstalled or remedial action performed as directed at no additional cost or additional time to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation will be provided to maintain continuity of operation of existing facilities.

B. The Contractor will provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment will be properly supported, sloped to drain, operate without excessive stress, and will be insulated where injury can occur to personnel by contact with operating facilities. The requirements of paragraph 3.1 will apply.

C. Temporary facilities and piping will be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs are prohibited in potable water systems. Necessary blind flanges and caps will be provided to seal open piping remaining in service.

3.3 RIGGING

A. Openings in building structures will be planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.

C. All openings in the building will be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor will provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures will be Contractor's full responsibility.

E. Contractor will check all clearances, weight limitations and will provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, will be at Contractor's cost, time and responsibility.

F. Rigging plan and methods will be referred to COR for evaluation prior to actual work.

3.4 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes will be drilled or burned in structural steel ONLY with the prior written approval of the COR.

B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above will not be permitted. Rusty products will be replaced.

C. Hanger rods will be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work will be provided.

D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC) and these specifications.

E. Overhead Supports:

1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
3. Tubing and capillary systems will be supported in channel troughs.

F. Floor Supports:
   1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems will be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
   2. Bases and supports will not be located and installed until equipment mounted thereon has been approved. Bases will be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings will be reviewed for additional requirements. Bases will be neatly finished and smoothed, will have chamfered edges at the top, and will be suitable for painting.
   3. All equipment will be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts will be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.

3.5 LUBRICATION

A. All equipment and devices requiring lubrication will be lubricated prior to initial operation. All devices and equipment will be field checked for proper lubrication.
B. All devices and equipment will be equipped with required lubrication fittings. A minimum of 1 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application will be provided. All materials will be delivered to COR in unopened containers that are properly identified as to application.
C. A separate grease gun with attachments for applicable fittings will be provided for each type of grease applied.
D. All lubrication points will be accessible without disassembling equipment, except to remove access plates.
E. All lubrication points will be extended to one side of the equipment.

3.6 PLUMBING SYSTEMS DEMOLITION

A. Rigging access, other than indicated in the drawings, will be provided after approval for structural integrity by the COR. Such access will be provided at no additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris will be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.
B. In an operating plant, cleanliness and safety will be maintained. The plant will be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work will be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris will not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting will be performed to maintain the fire safety integrity of this plant. Adequate fire

extinguishing facilities will be available at all times. All work will be performed in accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel of the VAMC, and the Contractor will follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work will be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings will be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system will be maintained. Reference will also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. All valves including gate, globe, ball, butterfly and check, all pressure gauges and thermometers with wells will remain Government property and will be removed and delivered to COR and stored as directed. The Contractor will remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material will be removed from Government property expeditiously and will not be allowed to accumulate. Coordinate with the COR and Infection Control.

3.7 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment, and systems will be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning will be thorough. Solvents, cleaning materials and methods recommended by the manufacturers will be used for the specific tasks. All rust will be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions will be repaired prior to applying prime and finish coats.
2. The following Material and Equipment will NOT be painted:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.

h. Valve stems and rotating shafts.
i. Pressure gauges and thermometers.
j. Glass.
k. Name plates.

3. Control and instrument panels will be cleaned and damaged surfaces repaired. Touch-up painting will be made with matching paint type and color obtained from manufacturer or computer matched.
4. Pumps, motors, steel and cast-iron bases, and coupling guards will be cleaned, and will be touched-up with the same paint type and color as utilized by the pump manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats per Section 09 91 00, Painting.
6. The final result will be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment will be repainted, if necessary, to achieve this. Lead based paints will not be used.

3.8 IDENTIFICATION SIGNS

A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, will be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols will correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, and performance data will be placed on factory-built equipment.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.9 STARTUP AND TEMPORARY OPERATION

A. Startup of equipment will be performed as described in the equipment specifications. Vibration within specified tolerance will be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

B. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Contracting Officer’s Representative and CxA. Provide a minimum of 4 weeks prior notice.

3.10 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, all required tests will be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

C. When completion of certain work or systems occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings during the first actual seasonal use of the respective systems following completion of work. Rescheduling of these tests will be requested in writing to COR for approval.

3.11 OPERATION AND MAINTENANCE MANUALS

A. All new and temporary equipment and all elements of each assembly will be included.

B. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information will be included.

C. Manufacturer's installation, maintenance, repair, and operation instructions for each device will be included. Assembly drawings and parts lists will also be included. A summary of operating precautions and reasons for precautions will be included in the Operations and Maintenance Manual.

D. Lubrication instructions, type and quantity of lubricant will be included.

E. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications will be included.

F. Set points of all interlock devices will be listed.

G. Trouble-shooting guide for the control system troubleshooting will be inserted into the Operations and Maintenance Manual.

H. The control system sequence of operation corrected with submittal review comments will be inserted into the Operations and Maintenance Manual.

I. Emergency procedures for shutdown and startup of equipment and systems.

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SECTION 22 05 12
GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the general motor requirements for plumbing equipment and applies to all sections of Division 22.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

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

D. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

E. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

F. Section 26 29 11, MOTOR CONTROLLERS: Starters, control and protection of motors.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and VHA standard will govern.

B. American Bearing Manufacturers Association (ABMA):

ABMA 9–2015 ..... Load Ratings and Fatigue Life for Ball Bearings

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

112-2017 ..... IEEE Standard Test Procedure for Polyphase Induction Motors and Generators

841-2018 ..... IEEE Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 HP)

D. International Code Council (ICC):

IPC-2018 ..... International Plumbing Code

E. National Electrical Manufacturers Association (NEMA):

MG 1-2016 ..... Motors and Generators

MG 2-2014 ..... Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators

250-2018 ..... Enclosures for Electrical Equipment (1000 Volts Maximum)

F. National Fire Protection Association (NFPA):
70-2020..... National Electrical Code (NEC)

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT”, with applicable paragraph identification.

C. Submit motor submittals with drive equipment.

D. Shop Drawings:

1. Provide documentation to demonstrate compliance with contract documents.
2. Motor nameplate information shall be submitted including electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
3. Motor parameters required for the determination of the Reed Critical Frequency of vertical hollow shaft motors shall be submitted.

E. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. iagrams shall have their terminals identified to facilitate installation, operation and maintenance.

G. Certification: Two weeks prior to final inspection, unless otherwise noted, the following certification shall be submitted to the Contracting Officer’s Representative (COR).

1. Certification shall be submitted stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

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 MOTORS

A. 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.

B. For alternating current, fractional and integral horsepower motors, NEMA MG 1 and NEMA MG 2 shall apply.

C. For severe duty totally enclosed motors, IEEE 841 shall apply. For severe duty totally enclosed motors, IEEE 841 shall apply.

D. Single-phase Motors: Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.

1. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

F. Voltage ratings shall be as follows:

1. Single phase:
   a. Motors connected to 120-volt systems: 115 volts.
   b. Motors connected to 208-volt systems: 200 volts.
   c. Motors connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
2. Three phase:
   a. Motors connected to 208-volt systems: 200 volts.
   b. Motors, less than 74.6 kW (100 HP), connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
   c. Motors, 74.6 kW (100 HP) or greater, connected to 240-volt systems: 230 volts.
   d. Motors, 74.6 kW (100 HP) or greater, connected to 480-volt systems: 460 volts.

e. Motors connected to high voltage systems (Over 600V): Shall conform to NEMA MG 1 for connection to the nominal system voltage shown in the drawings.

G. Number of phases shall be as follows:
1. Motors, less than 373 W (1/2 HP): Single phase.
2. Motors, 373 W (1/2 HP) and greater: 3 phase.
3. Exceptions:
a. Hermetically sealed motors.
b. Motors for equipment assemblies, less than 746 W (1 HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

H. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

I. Motor designs, by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting, acceleration and running torque without exceeding nameplate ratings or considering service factor.

J. Motor Enclosures:
1. Shall be the NEMA types as specified and/or shown in the Contract Documents.
2. Where the types of motor enclosures are not shown in the drawings, they shall be the NEMA types per NEMA 250, which are most suitable for the environmental conditions where the motors are being installed. Enclosure requirements for certain conditions are as follows:
a. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.
b. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.
c. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.
3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

K. Electrical Design Requirements:
1. Motors shall be continuous duty.
2. The insulation system shall be rated minimum of Class B, 130 degrees C (266 degrees F).
3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80 degrees C (144 degrees F).

4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
5. Motors shall be suitable for full voltage starting, unless otherwise noted. Coordinate motor features with applicable motor controllers.
6. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable Voltage or Adjustable Frequency Controls, or both, or NEMA MG 1, Part 31, Definite Purpose Inverter Fed Polyphase Motors.

L. Mechanical Design Requirements:

1. Bearings shall be rated for a minimum fatigue life of 26,280 hours for belt-driven loads and 100,000 hours for direct-drive loads based on L10 (Basic Rating Life) at full load direct coupled, except vertical high thrust motors which require a 40,000 hour rating. A minimum fatigue life of 40,000 hours is required for VFD drives.
2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30 percent of normal down thrust.
3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
4. Grease fittings, if provided, shall be Alemite type or equivalent.
5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 3.8 mm (0.15 inch) per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.
8. Motors on 180 frames and larger shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
9. All external fasteners shall be corrosion resistant.
10. Condensation heaters, when specified, shall keep motor windings at least 5 degrees C (9 degrees F) above ambient temperature.
11. Winding thermostats, when specified shall be normally closed, connected in series.
12. Grounding provisions shall be in the main terminal box.

M. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional cost or time to the Government.

2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
   b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
   c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.
4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated “inverter-duty” per NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

N. Additional requirements for specific motors, in other sections, shall also apply.

O. NEMA Premium Efficiency Electric Motors, Motor Efficiencies: All permanently wired polyphase motors of 746 W (1 HP) or greater shall meet the minimum full-load efficiencies in the following table, and as specified in this specification. Motors of 746 W (1 HP) or greater with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Efficiencies Open Drip-Proof				Minimum Efficiencies Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

P. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM. Power factor correction capacitors shall be provided unless the motor meets the 0.9 requirement without it or if the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

Q. Energy Efficiency of Small Motors (Motor Efficiencies): All motors under 746 W (1 hp) shall meet the requirements of the DOE Small Motor Regulation.

Polyphase Open Motors Average full load efficiency				Capacitor-start capacitor-run and capacitor-start induction run open motors Average full load efficiency			
Rating kW (hp)	**6 poles**	**4 poles**	**2 poles**	**Rating kW (hp)**	**6 poles**	**4 poles**	**2 poles**
0.18 (0.25)	67.5	69.5	65.6	0.18 (0.25)	62.2	68.5	66.6
0.25 (0.33)	71.4	73.4	69.5	0.25 (0.33)	66.6	72.4	70.5
0.37 (0.5)	75.3	78.2	73.4	0.37 (0.5)	76.2	76.2	72.4
0.55 (0.75)	81.7	81.1	76.8	0.55 (0.75)	80.2	81.8	76.2

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown in the drawings and/or by other sections of these specifications.

B. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 FIELD TESTS

A. All tests shall be witnessed by the CxA or by the COR.

B. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before startup. All shall test free from grounds.

C. Perform Load test in accordance with IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.

D. Insulation Resistance: Not less than 1/2 meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

E. All test data shall be complied into a report form for each motor and provided to the contracting officer or their representative.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

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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 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.

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 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 ..... Thermometers, Direct Reading and Remote Reading

C. American Water Works Association (AWWA):
C700-2015 ..... Cold Water Meters, Displacement Type, Bronze Main Case
C701-2015 ..... Cold Water Meters-Turbine Type, for Customer Service
C702-20115 ..... Cold Water Meters – Compound Type
C707-2010 (R2016) ..... Encoder-Type Remote-Registration Systems for Cold-Water Meters

D. Institute of Electrical and Electronics Engineers (IEEE):
C2–2017 ..... National Electrical Safety Code (NESC)

E. International Code Council (ICC):
IPC-2018 ..... International Plumbing Code

F. National Fire Protection Association (NFPA):
70–2020..... National Electrical Code (NEC)

G. NSF International (NSF):
61-2019 ..... Drinking Water System Components – Health Effects
372-2016 ..... Drinking Water System Components – Lead Content

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 05 19, METERS AND GAUGES FOR PLUMBING PIPING”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Pressure Gauges.
2. Thermometers.
3. Product certificates for each type of gauge.
4. BACnet communication protocol.

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.

1.5 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 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 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.

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.

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SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for general-duty valves for domestic water and sewer systems.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

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

E. APPLICABLE PUBLICATIONS: 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.

F. American Society of Mechanical Engineers (ASME):

A112.14.1-2003 ..... Backwater Valves

G. American Society of Sanitary Engineering (ASSE):

1001-2017 ..... Performance Requirements for Atmospheric Type Vacuum Breakers

1003-2009 ..... Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems

1011-2017 ..... Performance Requirements for Hose Connection Vacuum Breakers

1013-2011 ..... Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers

1015-2011 ..... Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies

1017-2009 ..... Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems

1020-2004 ..... Performance Requirements for Pressure Vacuum Breaker Assembly

1035-2008 ..... Performance Requirements for Laboratory Faucet Backflow Preventers

1069-2005 ..... Performance Requirements for Automatic Temperature Control Mixing Valves

1070-2015 ..... Performance Requirements for Water Temperature Limiting Devices

1071-2012 ..... Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment

H. 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

I. International Code Council (ICC):

IPC-2018 ..... International Plumbing Code

J. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-25-2018..... Standard Marking Systems for Valves, Fittings, Flanges and Unions

SP-67-2017..... Butterfly Valves

SP-70-2011..... Gray Iron Gate Valves, Flanged and Threaded Ends

SP-71-2018..... Gray Iron Swing Check Valves, Flanged and Threaded Ends

SP-80-2019..... Bronze Gate, Globe, Angle, and Check Valves

SP-85-2011..... Gray Iron Globe & Angle Valves, Flanged and Threaded Ends

SP-110-2010..... Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

K. National Environmental Balancing Bureau (NEBB):

8th Edition 2015 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

L. NSF International (NSF):

61-2019 ..... Drinking Water System Components – Health Effects

372-2016 ..... Drinking Water System Components – Lead Content

M. University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USC FCCCHR):

10th Edition..... Manual of Cross-Connection Control

1.3 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 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. Balancing Valves.
3. Check Valves.
4. Water Pressure Reducing Valves and Connections.
5. Backflow Preventers.

D. Thermostatic Mixing Valves. 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.

1.4 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 ball and plug valves open to minimize exposure of functional surfaces.
4. 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.

1.5 AS BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

A. Asbestos packing and gaskets are prohibited.

B. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing greater than 15 percent zinc shall not be permitted.

C. Valves in insulated piping shall have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.

D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 m (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.

E. All valves used to supply potable water shall meet the requirements of NSF 61 and NSF 372.

F. Bio-Based Materials: For products designated by the USDA's bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

G. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

2.2 SHUT-OFF VALVES

A. Cold, Hot and Re-circulating Hot Water:

1. 80 mm or DN80 (3 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. The ends shall be non-lead solder.

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. 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.

1. All check valves on the discharge side of submersible sump pumps shall have factory installed exterior level and weight with sufficient weight to prevent the check valve from hammering against the seat when the sump pump stops.

2.6 BACKFLOW PREVENTERS

A. A backflow prevention assembly shall be installed at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. The backflow prevention assembly shall be approved by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USCFCCC).

B. The reduced pressure principle backflow prevention assembly shall be ASSE listed 1013 with full port OS&Y positive-seal resilient gate valves and an integral relief monitor switch. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade 4. The seat ring and check valve shall be the thermoplastic type suited for water service. The stem shall be stainless steel conforming to ASTM A276/A276M. The seat disc shall be the elastomer type suited for water service. The checks and the relief valve shall be accessible for maintenance without removing the device from the line. An epoxy coated wye type strainer with flanged connections shall be installed on the inlet. Reduced pressure backflow preventers shall be installed in the following applications.

1. Water make up to heating systems, cooling tower, chilled water system, generators, and similar equipment consuming water.

C. The pipe applied or integral atmospheric vacuum breaker shall be ASSE listed 1001. The main body shall be cast bronze. The seat disc shall be the elastomer type suited for water service. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable. Atmospheric vacuum breakers shall be installed in the following applications.

1. Hose bibs and sinks with threaded outlets.
2. Service sinks (integral with faucet only).

D. The hose connection vacuum breaker shall be ASSE listed 1011. The main body shall be cast brass with stainless steel working parts. The diaphragm and disc shall be the elastomer type suited for water service. The device shall permit the attachment of portable hoses to hose thread outlets. Hose connection vacuum breakers shall be installed in the following locations requiring non-continuous pressure:

1. Hose bibbs and wall hydrants.

E. The pressure vacuum breaker shall be ASSE listed 1020. The main body shall be brass. The disc and O-ring seal shall be the elastomer type. The valve seat and disc float shall be the thermoplastic type. Tee handle or lever handle shut-off ball valves. Test cocks for testing and draining where freezing conditions occur. All materials shall be suitable for water service. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable.

2.7 THERMOSTATIC MIXING VALVES

A. Thermostatic Mixing Valves shall comply with the following general performance requirements:

1. Shall meet ASSE requirements for water temperature control.
2. The body shall be cast bronze or brass with corrosion resistant internal parts preventing scale and biofilm build-up. Provide chrome-plated finish in exposed areas.
3. No special tool shall be required for temperature adjustment, maintenance, replacing parts and disinfecting operations.
4. Valve shall be able to be placed in various positions without making temperature adjustment or reading difficult.
5. Valve finish shall be chrome plated in exposed areas.
6. Valve shall allow easy temperature adjustments to allow hot water circulation. Internal parts shall be able to withstand disinfecting operations of chemical and thermal treatment of water temperatures up to 82°C (180°F) for 30 minutes or 50 mg/L (50 ppm) chlorine residual concentration for 24 hours.
7. Parts shall be easily removed or replaced without dismantling the valves, for easy scale removal and disinfecting of parts.
8. Valve shall have a manual adjustable temperature control with locking mechanism to prevent tampering by end user. Outlet temperature shall be visible to ensure outlet temperature does not exceed specified limits, particularly after thermal eradication procedures.

B. Provide mixing valves with integral check valves with screens and stop valves.

C. Water Temperature Limiting Devices:

1. Application: Single plumbing fixture point-of-use such as sinks or lavatories.

2. Standard: ASSE 1070.
3. Pressure Rating: 861 kPa (125 psig).
4. Type: Thermostatically controlled water mixing valve set at 43 degrees C (110 degrees F).
5. Connections: Threaded union, compression or soldered inlets and outlet.
6. Upon cold water supply failure the hot water flow shall automatically be reduced to 0.2 gpm maximum.

D. Temperature Activated Mixing Valves:
1. Application: Emergency eye/face/drench shower equipment.
2. Standard: ASSE 1071.
3. Pressure Rating: 861 kPa (125 psig).
4. Type: Thermostatically controlled water mixing valve set at 24-30 degrees C (75-85 degrees F).
5. Connections: Soldered or threaded union inlets and outlet.
6. Cabinet: Factory-fabricated, stainless steel, for recessed or surface mounting and with hinged, stainless-steel door.
7. Thermometers shall be provided to indicate mixed water temperature.
8. Upon cold water supply failure the hot water flow shall automatically be reduced to 0.5 gpm maximum.

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 backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that shall be sources of contamination. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment or system.
   1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are prohibited for this application.
G. Install pressure gauges on outlet of backflow preventers.
H. Do not install bypass piping around backflow preventers.
I. 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.
J. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.
K. Install thermostatic balancing valves with inlet strainer and inlet and outlet isolation valves.
A. 3.3 LABELING AND IDENTIFYINGEquipment 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

C. 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.
D. 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.
E. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

F. 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.

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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, crawl spaces and pipe basements are not considered finished areas.
   7. FSK: Foil-scrim-Kraft facing.
   8. Hot: Plumbing equipment or piping handling media above 40 degrees C (104 degrees F).
   9. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).
   10. Thermal conductance: Heat flow rate through materials.
      a. Flat surface: Watts per square meter (BTU per hour per square foot).
      b. Pipe or Cylinder: Watts per linear meter (BTU per hour per linear foot) for a given outside diameter.
   11. Thermal Conductivity (k): Watts per meter, per degree K (BTU - inch thickness, per hour, per square foot, per degree F temperature difference).
   12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders/vapor barriers shall have a maximum published permeance of .02 perms.
   13. HWR: Hot water recirculating.
   14. CW: Cold water.

15. SW: Soft water.
16. HW: Hot water.
17. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Insulation material and insulation production method.
D. Section 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. American Society for Testing and Materials (ASTM):

B209-2014 ..... Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
C411-2011 ..... Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
C449-2007 (R2013) ..... Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
C450-2008 (R2014) ..... Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging
Adjunct to C450 ..... Compilation of Tables that Provide Recommended Dimensions for Prefab and Field Thermal Insulating Covers, etc.
C533-2013 ..... Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
C534/C534M-2014 ..... Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
C547-2015 ..... Standard Specification for Mineral Fiber Pipe Insulation
C552-2014 ..... Standard Specification for Cellular Glass Thermal Insulation
C553-2013 ..... Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C591-2013 ..... Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

C680-2014 ..... Standard Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs

C612-2014 ..... Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126-2014 ..... Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-2012 ..... Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

C1710-2011 ..... Standard Guide for Installation of Flexible Closed Cell Preformed Insulation in Tube and Sheet Form

D1668/D1668M-1997a (2014)e1 Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-2015a ..... Standard Test Method for Surface Burning Characteristics of Building Materials

E2231-2015 ..... Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation to Assess Surface Burning Characteristics

C. Federal Specifications (Fed. Spec.):

L-P-535E-1979 ..... Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

D. International Code Council, (ICC):

IMC-2012..... International Mechanical Code

E. Military Specifications (Mil. Spec.):

MIL-A-3316C (2)-1990 ..... Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (2)-1987..... Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-PRF-19565C (1)-1988..... Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier

MIL-C-20079H-1987 ..... Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

F. National Fire Protection Association (NFPA):

90A-2015 ..... Standard for the Installation of Air-Conditioning and Ventilating Systems

G. Underwriters Laboratories, Inc (UL):

723-2008 (R2013) ..... Standard for Test for Surface Burning Characteristics of Building Materials

1887-2004 (R2013) ..... Standard for Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics

H. 3E Plus® version 4.1 Insulation Thickness Computer Program: Available from NAIMA with free download; https://insulationinstitute.org/tools-resources/

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 07 11, PLUMBING INSULATION”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

D. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM Designation, Federal and Military specifications.
   a. Insulation materials: Specify each type used and state surface burning characteristics.
   b. Insulation facings and jackets: Each type used and state surface burning characteristics.
   c. Insulation accessory materials: Each type used.
   d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation shall follow the guidelines in accordance with ASTM C1710.
   e. Make reference to applicable specification paragraph numbers for coordination.
   f. All insulation fittings (exception flexible unicellular insulation) shall be fabricated in accordance with ASTM C450 and the referenced Adjunct to ASTM C450.

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 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 Government 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 shall be provided, and a copy of them in Auto-CAD 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 by printed instructions of manufacturers of adhesives, mastics and finishing cements.

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m^3 (nominal 3 pcf), k = 0.037 (.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).

B. ASTM C553 (Blanket, Flexible) Type I, Class B-5, Density 32 kg/m^3 (nominal 2 pcf), k = 0.04 (0.27) at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F).

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (446 degrees F) with an all service vapor retarder jacket (ASJ) and with polyvinyl chloride (PVC) premolded fitting covering.

2.2 RIGID CELLULAR PHENOLIC FOAM

A. Preformed (molded) pipe insulation, ASTM C1126, Type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with vapor retarder and all service vapor retarder jacket (ASJ) and with PVC premolded fitting covering.

B. Equipment Insulation, ASTM C1126, Type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket (ASJ).

2.3 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. 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.

E. 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.

F. Aluminum Jacket-Piping systems and circular breeching and stacks: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated or with cut aluminum gores to match shape of fitting and of 0.6 mm (0.024 inch) minimum thickness aluminum. Aluminum fittings shall be of same construction with an internal moisture barrier as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands with wing seals shall be installed on all circumferential joints. Bands shall be 15 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

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
200 (8), 250 (10), 300 (12)	225 (9) 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. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.

D. 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.

E. 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. 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 (NFPA 90A).

D. 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).

E. 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.

F. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment. Do not insulate over equipment nameplate data.

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. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

I. 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.

J. 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.

K. 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.

L. 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 include the following:
      a. Pipe risers through floors
      b. Pipe chase walls and floors
      c. Smoke partitions
      d. Fire partitions
      e. Hourly rated walls

M. Provide vapor barrier systems as follows:
   1. All interior piping conveying fluids exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces below ambient air temperature in high humidity locations.

N. Provide metal jackets over insulation as follows:
   1. Piping exposed in building, within 1829 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets except for cold pipe or tubing applications. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
   2. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

O. Provide PVC jackets over insulation as follows:
   1. Piping exposed in building, within 1829 mm (6 feet) of the floor, on piping that is not precluded in previous sections.
   2. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

3.2 INSULATION INSTALLATION

A. 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. Rigid Cellular Phenolic Foam:

1. Rigid closed cell phenolic insulation may be provided, exterior only, for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
2. Note the ASTM E84 or UL 723 surface burning characteristics requirements of maximum 25/50 indexes in paragraph "Quality Assurance".
3. Provide secure attachment facilities such as welding pins.
4. Apply insulation with joints tightly drawn together.
5. Apply adhesives, coverings, neatly finished at fittings, and valves.
6. Final installation shall be smooth, tight, neatly finished at all edges.
7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.
8. Condensation control insulation: Minimum 25 mm (1 inch) thick for all pipe sizes depending on high humidity exposures.
   a. Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.
   b. Waste piping from electric water coolers and icemakers to drainage system.
   c. Waste piping located above basement floor from ice making and air handling units, from equipment (including trap) to main vertical waste pipe.

3.3 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 Hot Water Supply and Return)	Rigid Cellular Phenolic Foam (Above ground piping only) (exterior locations only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
4-15 degrees C (40-60 degree F) (Cold water piping, storm & condensate drainage)	Mineral Fiber (Above ground piping only)	15 (0.5)	15 (0.5)	25 (1.0)	25 (1.0)
4-15 degrees C (40-60	Rigid Cellular	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)

degrees F) (Cold water piping, storm & condensate drainage)	Phenolic Foam (Above ground piping only)				

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SECTION 22 11 00
FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 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):

A13.1-2007 (R2013)..... Scheme for Identification of Piping Systems

B16.3-2011 ..... Malleable Iron Threaded Fittings: Classes 150 and 300

B16.9-2012 ..... Factory-Made Wrought Buttwelding Fittings

B16.11-2011 ..... Forged Fittings, Socket-Welding and Threaded

B16.12-2009 (R2014)..... Cast Iron Threaded Drainage Fittings

B16.15-2013 ..... Cast Copper Alloy Threaded Fittings: Classes 125 and 250

B16.18-2012 ..... Cast Copper Alloy Solder Joint Pressure Fittings

B16.22-2013 ..... Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.24-2011 ..... Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500

ASME Boiler and Pressure Vessel Code -

BPVC Section IX-2015..... Welding, Brazing, and Fusing Qualifications

C. 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 (R2014) ..... Standard Specification for Ferritic Malleable Iron Castings

A53/A53M-2012 ..... Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A183-2014 ..... Standard Specification for Carbon Steel Track Bolts and Nuts
A269/A269M-2014e1 ..... Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A312/A312M-2015 ..... Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
A403/A403M-2014 ..... Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
A536-1984 (R2014)..... Standard Specification for Ductile Iron Castings
A733-2013 ..... Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
B32-2008 (R2014) ..... Standard Specification for Solder Metal
B43-2014 ..... Standard Specification for Seamless Red Brass Pipe, Standard Sizes
B61-2008 (R2013) ..... Standard Specification for Steam or Valve Bronze Castings
B62-2009 ..... Standard Specification for Composition Bronze or Ounce Metal Castings
B75/B75M-2011 ..... Standard Specification for Seamless Copper Tube
B88-2014 ..... Standard Specification for Seamless Copper Water Tube
B584-2014 ..... Standard Specification for Copper Alloy Sand Castings for General Applications
B687-1999 (R2011)..... Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples
C919-2012 ..... Standard Practice for Use of Sealants in Acoustical Applications
D1785-2012 ..... Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
D2000-2012 ..... Standard Classification System for Rubber Products in Automotive Applications
D2564-2012 ..... Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
D2657-2007 ..... Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
D2855-1996 (R2010) ..... Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
D4101-2014 ..... Standard Specification for Polypropylene Injection and Extrusion Materials

E1120-2008 ..... Standard Specification for Liquid Chlorine
E1229-2008 ..... Standard Specification for Calcium Hypochlorite
F2389-2010 ..... Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems
F2620-2013 ..... Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
F2769-2014 ..... Standard Specification for Polyethylene of Raised Temperature (PE-RT) Plastic Hot and Cold-Water Tubing and Distribution Systems

E. American Water Works Association (AWWA):
C110-2012..... Ductile-Iron and Gray-Iron Fittings
C151-2009..... Ductile Iron Pipe, Centrifugally Cast
C153-2011 ..... Ductile-Iron Compact Fittings
C203-2008..... Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied
C213-2007..... Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
C651-2014..... Disinfecting Water Mains

F. American Welding Society (AWS):
A5.8M/A5.8-2011-AMD1 ..... Specification for Filler Metals for Brazing and Braze Welding

G. International Code Council (ICC):
IPC-2012 ..... International Plumbing Code

H. Manufacturers Specification Society (MSS):
SP-58-2009..... Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation
SP-72-2010a..... Ball Valves with Flanged or Butt-Welding Ends for General Service
SP-110-2010..... Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

I. NSF International (NSF):
14-2015 ..... Plastics Piping System Components and Related Materials
61-2014a ..... Drinking Water System Components – Health Effects
372-2011 ..... Drinking Water System Components – Lead Content

J. Plumbing and Drainage Institute (PDI):
PDI-WH 201-2010..... Water Hammer Arrestors

K. Department of Veterans Affairs:
H-18-8-2013..... Seismic Design Handbook

H-18-10 ..... Plumbing Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 11 00, FACILITY WATER DISTRIBUTION”, 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. 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 Government 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 shall be provided, and a copy of them in Auto-CAD 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 **<u>are prohibited</u>**. See Plumbing Design Manual for additional information.
4. Flanged fittings, bronze, class 150, solder-joint ends conforming to ASME B16.24.

C. Adapters: Provide adapters for joining pipe or tubing with dissimilar end connections.

D. Solder: ASTM B32 alloy type Sb5, HA or HB. Provide non-corrosive flux.

E. Brazing alloy: AWS A5.8M/A5.8, brazing filler metals shall be BCuP series for copper to copper joints and BAg series for copper to steel joints.

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 STRAINERS

A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.

B. Water: Basket or "Y" type with easily removable cover and brass strainer basket.

C. Body: Less than 75 mm (3 inches), brass or bronze; 75 mm (3 inches) and greater, cast iron or semi-steel.

2.6 DIELECTRIC FITTINGS

A. Provide dielectric couplings or unions between pipe of dissimilar metals.

2.7 STERILIZATION CHEMICALS

A. Hypochlorite: ASTM E1229.

B. Liquid Chlorine: ASTM E1120.

2.8 WATER HAMMER ARRESTER

A. Closed copper tube chamber with permanently sealed 413 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N 0-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010. Access shall be provided where devices are concealed within partitions or above ceilings. Size and install in accordance with PDI-WH 201 requirements. Provide water hammer arrestors at:

1. All solenoid valves.
2. All groups of two or more flush valves.
3. All quick opening or closing valves.
4. All medical washing equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with the International Plumbing Code and the following:
   1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
   2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to remove burrs and a clean smooth finish restored to full pipe inside diameter.
   3. All pipe runs shall be laid out to avoid interference with other work/trades.
   4. Install union and shut-off valve on pressure piping at connections to equipment.
   5. Pipe Hangers, Supports and Accessories:
      a. All piping shall be supported per the IPC, H-18-8 Seismic Design Handbook, MSS SP-58, and SMACNA.
      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 shall be used with copper tubing.
      c. Floor, Wall and Ceiling Plates, Supports, Hangers:
         1) Solid or split un-plated cast iron.
         2) All plates shall be provided with set screws.
         3) Pipe Hangers: Height adjustable clevis type.
         4) Adjustable Floor Rests and Base Flanges: Steel.
         5) Concrete Inserts: "Universal" or continuous slotted type.
         6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
         7) Pipe Hangers and Riser Clamps: Malleable iron or carbon steel. Pipe Hangers and riser clamps shall have a copper finish when supporting bare copper pipe or tubing.
         8) Rollers: Cast iron.
         9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
         10) Hangers and supports utilized with insulated pipe and tubing shall have 180-degree (minimum) metal protection shield centered on and welded to the hanger and support. The shield thickness and length shall be engineered and sized for

distribution of loads to preclude crushing of insulation without breaking the vapor barrier. The shield shall be sized for the insulation and have flared edges to protect vapor-retardant jacket facing. To prevent the shield from sliding out of the clevis hanger during pipe movement, center-ribbed shields shall be used.

11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.

12) With the installation of each flexible expansion joint, provide piping restraints for the upstream and downstream section of the piping at the flexible expansion joint. Provide calculations supporting the restraint length design and type of selected restraints. Restraint calculations shall be based on the criteria from the manufacturer regarding their restraint design.

6. Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Penetrations:
   a. Firestopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke, and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the firestopping materials.
   b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.
   c. Acoustical sealant: Where pipes pass through sound rated walls, seal around the pipe penetration with an acoustical sealant that is compliant with ASTM C919.

B. 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 shall 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. All Other Piping Tests: Test new installed piping under 1-1/2 times actual operating conditions and prove tight.

D. 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 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.

E. Section 07 92 00, JOINT SEALANTS: Sealant products.

F. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.

G. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.

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. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):

A13.1-2007 ..... Identification of Piping Systems
A112.36.2M-1991 ..... Cleanouts
A112.6.3-2019 ..... Floor and Trench Drains
B1.20.1-2013 ..... Pipe Threads, General Purpose (Inch)
B16.1-2015 ..... Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
B16.4-2016 ..... Grey Iron Threaded Fittings Classes 125 and 250
B16.15-2018 ..... Cast Copper Alloy Threaded Fittings, Classes 125 and 250
B16.18-2018 ..... Cast Copper Alloy Solder Joint Pressure Fittings
B16.21-2016 ..... Nonmetallic Flat Gaskets for Pipe Flanges
B16.22-2018 ..... Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
B16.23-2016 ..... Cast Copper Alloy Solder Joint Drainage Fittings: DWV
B16.24-2016 ..... Cast Copper Alloy Pipe Flanges and Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500

B16.29-2017 ..... Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings: DWV

B16.39-2014 ..... Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300

B18.2.1-2012 ..... Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

C. American Society of Sanitary Engineers (ASSE):

1001-2017 ..... Performance Requirements for Atmospheric Type Vacuum Breakers

1018-2001 ..... Performance Requirements for Trap Seal Primer Valves – Potable Water Supplied

1044-2015 ..... Performance Requirements for Trap Seal Primer Devices – Drainage Types and Electronic Design Types

1079-2012 ..... Performance Requirements for Dielectric Pipe Unions

D. American Society for Testing and Materials (ASTM):

A53/A53M-2018 ..... Standard Specification for Pipe, Steel, Black And Hot-Dipped, Zinc-coated, Welded and Seamless

A74-2017 ..... Standard Specification for Cast Iron Soil Pipe and Fittings

A888-2018a ..... Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

B32-2008(R2014) ..... Standard Specification for Solder Metal

B43-2015 ..... Standard Specification for Seamless Red Brass Pipe, Standard Sizes

B88-2016 ..... Standard Specification for Seamless Copper Water Tube

B306-2013 ..... Standard Specification for Copper Drainage Tube (DWV)

B687-1999(R2016)..... Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples

B813-2016 ..... Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube

B828-2016 ..... Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

C564-2014 ..... Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

D2321-2018 ..... Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2564-2012(R3018) ..... Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

D2665-2014 ..... Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D2855-2015 ..... Standard Practice for Two-Step (Primer and Solvent Cement) Method of Joining Poly(Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) CPVCP Pipe and Piping Components with Tapered Sockets

D5926-2015 ..... Standard Specification for Poly(Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

F402-2018 ..... Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

F477-2014 ..... Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F1545-2015e1 ..... Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges

E. Cast Iron Soil Pipe Institute (CISPI):

2006 ..... Cast Iron Soil Pipe and Fittings Handbook

301-2012 ..... Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

310-2012 ..... Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

F. Copper Development Association, Inc. (CDA):

A4015-14/19 ..... Copper Tube Handbook

G. International Code Council (ICC):

IPC-2018 ..... International Plumbing Code

H. Manufacturers Standardization Society (MSS):

SP-123-2018..... Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube

I. National Fire Protection Association (NFPA):

70-2020 ..... National Electrical Code (NEC)

J. Underwriters' Laboratories, Inc. (UL):

508-99 (R2013)..... Standard For Industrial Control Equipment

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 13 00, FACILITY SANITARY AND VENT PIPING”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Piping.
2. Floor Drains.
3. Cleanouts.
4. Trap Seal Protection.
5. Penetration Sleeves.
6. Pipe Fittings.
7. Traps.
8. 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.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 SANITARY WASTE, DRAIN, AND VENT PIPING

A. Cast iron waste, drain, and vent pipe and fittings.
   1. Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:
      a. 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.
   6. Heavy duty couplings (I.E. Husky Brand) shall be provided. Couplings shall be series 300 stainless steel shield with clamp assembly and elastomeric sealing sleeve and center stop to prevent contact between piping and fittings being joined. 3" wide couplings with four sealing bands shall be provided for piping 1.5" to 4" in size. 4" wide coupling with six sealing bands shall be provided for piping 5" to 10" in size. Couplings shall be designed to be torqued to 80 psi at each sealing band to accommodate any hydraulic jump.

B. Copper Tube, (DWV):
   1. Copper DWV tube sanitary waste, drain and vent pipe may be used for piping above ground, except for urinal drains.
   2. The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.
   3. The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME B16.29.
   4. The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.

2.2 PUMP DISCHARGE PIPING

A. Galvanized steel pump discharge pipe and fittings:
   1. Galvanized steel pipe shall be Schedule 40 weight class conforming to ASTM A53/A53M, with square cut grooved or threaded ends to match joining method.
   2. Fittings shall be Class 125, gray-iron threaded fittings conforming to ASME B16.4.
   3. Unions shall be Class 150 hexagonal-stock body with ball and socket, metal to metal, bronze seating surface, malleable iron conforming to ASME B16.39 with female threaded ends.
   4. Flanges shall be Class 125 cast iron conforming to ASME B16.1.
      a. Flange gaskets shall be full face, flat nonmetallic, asbestos free conforming to ASME B16.21.

b. Flange nuts and bolts shall be carbon steel conforming to ASME B18.2.1.

B. Copper pump discharge pipe and fittings:

1. Copper tube shall be hard drawn Type L conforming to ASTM B88.
2. Fittings shall be cast copper alloy conforming to ASME B16.18 or wrought copper conforming to ASME B16.22 with solder joint ends.
3. Unions shall be copper alloy, hexagonal stock body with ball and socket, metal to metal seating surface conforming to MSS SP-123 with female solder-joint or threaded ends.
4. Flanges shall be Class 150, cast copper conforming to ASME B16.24 with solder-joint end.
   a. Flange gaskets shall be full face, flat nonmetallic, asbestos free conforming to ASME B16.21.
   b. Flange nuts and bolts shall be carbon steel conforming to ASME B18.2.1.
5. Solder shall be lead free, water flushable flux conforming to ASTM B32 and ASTM B813.

2.3 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.

2.4 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.

2.5 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.

2.6 FLOOR DRAINS

A. General Data: floor drain shall comply with ASME A112.6.3. A caulking flange, inside gasket, or hubless connection shall be provided for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe. The drain connection shall be bottom outlet. A membrane clamp and extensions shall be provided, if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening shall not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe. For drains not installed in connection with a waterproof membrane, a 1.1 to 1.8 Kg (2.5 to 4 lbs.) flashing membrane, 600 mm (24 inches) square or another approved waterproof membrane shall be provided.

B. Type C (FD-C) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type C floor drain shall have a cast iron body, double drainage pattern, clamping device, light duty nickel bronze adjustable strainer with round or square grate of 150 mm (6 inches) width or diameter minimum for toilet rooms, showers and kitchens.

C. Type D (FD-D) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type D floor drain shall have a cast iron body, double drainage pattern, clamping device, light duty nickel bronze recessed strainer with round or square grate of 150 mm (6 inches) width or diameter minimum for toilet rooms, showers and kitchens.

2.7 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.

2.8 PRIMER VALVES AND TRAP SEAL PRIMER SYSTEMS

A. Trap Primer: 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.

2.9 PENETRATION SLEEVES

A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that shall extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that shall extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.

B. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.

C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.

D. All pipe runs shall be laid out to avoid interference with other work.

E. The piping shall be installed above accessible ceilings where possible.

F. The piping shall be installed to permit valve servicing or operation.

G. The piping shall be installed free of sags and bends.

H. Seismic restraint shall be installed where required by code.

I. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow greater than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Buried soil and waste drainage and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.

K. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"

L. Aboveground copper tubing shall be installed according to Copper Development Association's (CDA) "Copper Tube Handbook".

M. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 JOINT CONSTRUCTION

A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

C. Hubless or No-hub, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.

D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service.
2. Pipe sections with damaged threads shall be replaced with new sections of pipe.

E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead-free alloy solder conforming to ASTM B32 shall be used.

3.3 SPECIALTY PIPE FITTINGS

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES

A. All piping shall be supported according to the International Plumbing Code (IPC), Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications. Where conflicts arise between these the code and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.

B. Hangers, supports, rods, inserts and accessories used for pipe supports shall be painted according to Section 09 91 00, PAINTING. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
   1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
   2. 75 mm or DN75 (NPS 3 inch): 1500 mm (60 inches) with 15 mm (1/2 inch) rod.
   3. 100 mm or DN100 to 125 mm or DN125 (NPS 4 inch to NPS 5 inch): 1500 mm (60 inches) with 18 mm (5/8 inch) rod.

E. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.6 m (15 feet).

F. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, Floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:
   1. Solid or split unplated cast iron.
   2. All plates shall be provided with set screws.
   3. Height adjustable clevis type pipe hangers.
   4. Adjustable floor rests and base flanges shall be steel.
   5. Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
   6. Riser clamps shall be malleable iron or steel.
   7. Rollers shall be cast iron.
   8. See Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, for requirements on insulated pipe protective shields at hanger supports.

G. Miscellaneous materials shall be provided as specified, required, directed or as noted in the contract documents for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.

H. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

I. Penetrations:
   1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
   2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

J. Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

3.5 TESTS

A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.

B. Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

1. If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
2. For an air test, an air pressure of 34 kPa (5 psig) gauge shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gauge shall be used for the air test.
3. After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.
4. Final Tests: Either one of the following tests may be used.
   a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of .25 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.
   b. Peppermint Test: Introduce 60 ml (2 ounces) of peppermint into each line or stack.

- - - E N D - - -

SECTION 22 14 29
SUMP PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Sump pumps. See schedule on Drawings for pump capacity and head.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

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

E. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

F. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING

G. 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.

B. American National Standard Institute (ANSI)/Hydraulic Institute (HI):

1.1-1.2-2014 ..... Rotodynamic Centrifugal Pumps for Nomenclature and Definitions

1.3-2013 ..... Rotodynamic Centrifugal Pumps for Design and Application

1.4-2014 ..... Rotodynamic Centrifugal Pumps for Manuals Describing Installation, Operation, and Maintenance

C. ASTM International (ASTM):

A48/A48M-2003 (R2012) ..... Standard Specification for Gray Iron Castings

A532/A532M-2010 (R2014)..... Standard Specification for Abrasion-Resistant Cast Irons

B584-2014 ..... Standard Specification for Copper Alloy Sand Castings for General Applications

D. National Electrical Manufacturers Association (NEMA):

ICS 6-1993 (R2001, R2006)..... Industrial Control and Systems: Enclosures

250-2014 ..... Enclosures for Electrical Equipment (1000 Volts Maximum)

E. Underwriters' Laboratories, Inc. (UL):

508-1999 (R2013)..... Standards 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 14 29, SUMP PUMPS”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Pump:
   a. Manufacturer and model.
   b. Operating speed (rpm).
   c. Capacity.
   d. Characteristic performance curves.
2. Electric Motor:
   a. Manufacturer, frame and type.
   b. Speed.
   c. Current Characteristics and W (HP).
   d. Efficiency.
3. Control panel.
4. Sensors.

D. Certified copies of all the factory and construction site test data sheets and reports.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:

1. Include complete list which indicates 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, and troubleshooting.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version on compact disc or DVD 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 Government 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 shall be provided, and a copy of them in Auto-CADD 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 a certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 SUMP PUMP

A. Centrifugal, vertical, submersible pump and motor, designed for 60 degrees C (140 degrees F) maximum water service. Driver shall be electric motor. Support shall be rigid type. Provide perforated, suction strainer. Pump shall be capable of continuous duty cycle.

   1. Pump housings shall be cast iron, bronze, aluminum or stainless steel. Cast iron and aluminum housings for submersible pumps shall be epoxy coated. Bio-based materials shall be utilized when possible.

B. Impeller: Statically and dynamically balanced, keyed and secured to shaft, bronze ASTM B584.

C. Shaft: Stainless steel or other approved corrosion-resisting metal.

D. Bearings: To hold shaft alignment, anti-friction type for thrust permanently lubricated. Bio-based materials shall be utilized when possible.

E. Seal: Mechanical.

F. Motor: Maximum 40 degrees C (104 degrees F) ambient temperature rise above the maximum fluid temperature being pumped, drip-proof hermitically sealed, lifting eye, capacitor start type, voltage and phase as shown in schedule on Electrical drawings conforming to NEMA Type 4X. Size the motor capacity to operate pump without overloading the motor at any point on the pump curve. Refer to Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

G. Starting Switch: Manually-operated, tumbler type, as specified in Section 26 29 11, MOTOR CONTROLLERS.

H. Automatic Control and Level Alarm: Furnish a control panel in a NEMA 1 enclosure for indoors or in a NEMA 4X enclosure for outdoors. The controls shall be suitable for operation with the electrical characteristics listed on the Electrical drawings. The control panel shall have a level control system with switches to start and stop pumps automatically, and to activate a high-water alarm. The level control system shall include sensors in the sump that detect the level of the liquid. The pump is also connected to a control which has the ability to prevent oil from being pumped. The same unit shall activate an alarm when oil is detected. The sensors shall be float type switches, ultrasonic level sensors, or transducers. The high-water alarm shall have a red beacon light at the control panel and a buzzer, horn, or bell. The alarm shall have a silencing switch. Provide auxiliary contacts for remote communication with, and alarm monitoring to, the BAS using a BACnet compatible open-protocol type interface to DDC Controls System.

1. The circuitry of the control panel shall include:
   a. Power switch to turn on/off the automatic control mechanism
   b. HOA switches to manually override automatic control mechanism
   c. Run lights to indicate when pumps are powered up
   d. Level status lights to indicate when water in sump has reached the predetermined on/off and alarm levels
   e. Magnetic motor contactors
   f. Disconnect/breaker for each pump
   g. Automatic motor overload protection
   h. Wiring terminal block
   i. Dead front
   j. Auxiliary contacts
   k. Control circuit protection
   l. Fused control step down transformer
2. Sensors that detect the level of water in the sump shall be so arranged as to allow the accumulation of enough volume of liquid below the normal on-level that the pump will run for a minimum cycle time as recommended by the pump manufacturer. Sensors shall be located to activate the alarm adequately before the water level rises to the inlet pipe.
3. Provide a pump switch to sense the presence of oil. The sensor probes shall be made of high quality 304 stainless steel and able to distinguish between oil and water. The probes shall call for the pump to run when they sense water and turn off when sensing oil or air. The alarm shall be contained in a NEMA 4X enclosure that will sound an audible alarm if the liquid level becomes too high. There shall be dry contacts for each light/alarm. The oil alarm shall include a 20′ power cord to be plugged into an 115 V outlet.
4. Provide two separate power supplies to the control panel, one for the control/alarm circuitry and one for power to the pump motors. Each power supply is to be fed from its own breaker

so that if a pump overload trips a breaker, the alarm system shall still function. Each power supply is to be wired in its own conduit.

5. Wiring from the sump to the control panel shall have separate conduits for the pump power and for the sensor switches. All conduits shall be sealed at the basin and at the control panel to prevent the intrusion of moisture and of flammable and/or corrosive gases.

I. Sump: Furnish polyethylene basin with gas tight covers. Cover shall have 275 mm by 381 mm (11 inch by 15 inch) manhole with bolted cover, vent connection, openings for pumps and controls. Sump shall be sized to allow an adequate volume of water to accumulate for a minimum one minute cycle of pump operation.

J. Provide a check and ball valve in the discharge of each pump. Refer to Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING.

K. Removal/Disconnect System: In a system utilizing a submersible pump, where sump depth, pump size, or other conditions make removal of the pump unusually difficult or unsafe, a manufacturer's removal/disconnect system shall be provided. The system shall consist of a discharge fitting mounted on vertical guide rails attached to the sump or quick connect pipe fitting connection to piping. The pump shall be fitted with an adapter fitting that easily connects to/disconnects from the discharge fitting as the pump is raised from or lowered into the sump. The discharge piping shall connect to the discharge fitting so that it is disconnected without workers entering the pit. Where the sump depth is greater than five feet or other conditions exist to make the removal of the pump difficult or hazardous, the system shall include a rail guided quick disconnect apparatus to allow the pump to be pulled up out of the sump.

PART 3 - EXECUTION

3.1 STARTUP AND TESTING

A. Pump installation to comply with ANSI/HI 1.4 for sump pumps.

B. Leak Test: Charge piping system and test for leaks. Test until there are no leaks. Make 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.

C. The tests shall include system capacity and all control and alarm functions.

D. When any defects are detected, correct defects and repeat test.

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SECTION 22 33 00
ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for installing a complete electric domestic water heater system ready for operation including the water heaters, thermometers, and all necessary accessories, connections, and equipment.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

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

E. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING.

F. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. American National Standard Institute (ANSI):

Z21.22-2015 ..... Relief Valves for Hot Water Supply Systems

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

90.1-2019 ..... Energy Standard for Buildings Except Low-Rise Residential Buildings

D. American Society of Mechanical Engineers (ASME):

ASME Boiler and Pressure Vessel Code

BPVC Section IV-2019..... Rules for Construction of Heating Boilers

BPVC Section VIII-1-2019..... Rules for Construction of Pressure Vessels, Division 1

Form U-1 ..... Manufacturer's Data Report for Pressure Vessels

B1.20.1-2013 ..... Pipe Threads, General Purpose (Inch)

B1.20.7-1991 ..... Hose Coupling Screw Threads (Inch)

B16.5-2017 ..... Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

B16.24-2016 ..... Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500

CSD-1-2018..... Controls and Safety Devices for Automatically Fired Boilers

E. Federal Energy Management Program (FEMP):
https://www.energy.gov/eere/femp

F. National Fire Protection Association (NFPA)
70-2020 ..... National Electrical Code (NEC)

G. NSF International (NSF):
5-2019 ..... Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment
61-2018 ..... Drinking Water System Components – Health Effects
372-2016 ..... Drinking Water System Components – Lead Content

H. Underwriters Laboratories, Inc. (UL):
174-2004(R2019)..... Standard for Household Electric Storage Tank Water Heaters
499-2014(R2017)..... Standard for Electric Heating Appliances
1453-2016(R2018)..... Standard for Electric Booster and Commercial Storage Tank Water Heaters

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 33 00, ELECTRIC DOMESTIC WATER HEATERS”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Water Heaters.
   2. Pressure and Temperature Relief Valves.
   3. Thermometers.
   4. Pressure Gauges.
   5. Vacuum Breakers.
   6. Expansion Tanks.

D. For each electric domestic hot water heater type and size, the following characteristics shall be submitted:
   1. Rated Capacities.
   2. Operating characteristics.
   3. Electrical characteristics.
   4. Furnished specialties and accessories.
   5. A Form U-1 or other documentation stating compliance with the ASME Boiler and Pressure Vessel Code.

E. Shop drawings shall include wiring diagrams for power, signal and control functions.

F. Submit documentation indicating compliance with applicable requirements with ASHRAE 90.1 for Service Water Heating.

G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 QUALITY ASSURANCE

A. For commercial applications, comply with ASHRAE 90.1 for efficiency performance.

B. Electrical components, devices and accessories shall be listed and labeled as defined in NFPA 70 by a qualified testing agency and marked for intended location and application.

C. ASME code construction shall be a vessel fabricated in compliance with the ASME BPVC Section VIII-1.

D. Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

E. The domestic water heater shall be certified and labeled by an independent testing agency.

F. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit https://www.biopreferred.gov.

G. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph AS-BUILT DOCUMENTATION of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 ELECTRIC DOMESTIC WATER HEATERS

A. The tank construction shall be stainless-steel, with an inner tank liner extended into the openings complying with NSF 61 and NSF 372 for barrier materials for potable water. The vessel shall be ASME BPVC Section VIII-1, fabricated with a pressure rating of 1035 kPa (150 psig). Provide with access for cleaning and disinfection.

B. Tapping (openings) shall be Factory-fabricated of materials compatible with the tank and in accordance with appropriate ASME standards B1.20.1 for piping connections, pressure and temperature relief valve, pressure gauge, thermometer, drain valve, anode rods and controls. Tappings shall comply with the following ASME standards listed below:

1. 50 mm or DN50 (NPS 2 inch) and smaller: Threaded ends according to ASME B1.20.1.
2. 65 mm or DN65 (NPS 2-1/2 inch) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24.

C. Tank insulation shall comply with ASHRAE 90.1 and ENERGY STAR requirements.

D. For domestic water heater sizes greater than 9 KW, the heating element shall be arranged in multiples of three elements. For heaters less than 9 KW, the heater elements shall be arranged in single elements. Heater capacities are scheduled on the drawings.

E. The domestic water heaters shall have screw in or bolt on immersion type, thermostatically adjustable elements. Set thermostat for minimum water storage temperature of 60 degrees C (140 degrees F). The electrical characteristics are scheduled on the drawings. Heaters shall be capable of raising the discharge temperature to 77 to 82 degrees C (170 to 180 degrees F) for thermal eradication.

F. The Combination Pressure and Temperature relief Valve shall be ANSI Z21.22 and ASME rated.

G. The anode rod shall be replaceable magnesium.

H. The drain valve shall be corrosion resistant metal. A drain valve shall be installed at the bottom of each tank-type water heater and hot water storage tank. The drain valve inlet shall not be less than 20 mm or DN20 (NPS 3/4 inch) with ASME B1.20.7 garden hose threads.

I. Comply with NSF 5 for water heaters.

2.2 DOMESTIC HOT WATER EXPANSION TANKS

A. A steel pressure rated tank constructed with welded joints and factory installed butyl rubber diaphragm shall be installed as scheduled. The air precharge shall be set to minimum system operating pressure at tank.

B. The tappings shall be factory-fabricated steel, welded to the tank and include ASME B1.20.1 pipe thread.

C. The interior finish shall comply with NSF 61 and NSF 372 for barrier materials for potable water tank linings and the liner shall extend into and through the tank fittings and outlets.

D. The air charging valve shall be factory installed.

2.3 ELECTRIC WATER HEATER DRAIN PAN

A. A stainless-steel drain pan shall be provided that is 152 mm (6 inches) larger than the water heater and has a minimum of 152 mm (6 inch) sides. The drain pan shall include a drain outlet not less than 20 mm or DN20 (NPS 3/4 inch) with ASME B1.20.7 garden hose threads.

2.4 HEAT TRAPS

A. Heat traps shall be installed in accordance with ASHRAE 90.1 unless provided integrally with the heater.

2.5 COMBINATION TEMPERATURE AND PRESSURE RELIEF VALVES

A. The combination pressure and temperature relief valve shall be ANSI Z21.22 and ASME rated and constructed of all brass or bronze with a self-closing reseating valve. The relief valves shall

include a relieving capacity greater than the heat input and include a pressure setting less than the water heater's working pressure rating. Sensing element shall extend into storage tank.

2.6 THERMOMETERS

A. Thermometers shall be rigid stem or remote sensing, scale or dial type with an aluminum, black metal, stainless-steel, or chromium plated brass case. The thermometer shall be back connected, red liquid (alcohol or organic-based) fill, vapor, bi-metal or gas actuated, with 228 mm (9 inches) high scale dial or circular dial 50 to 127 mm (2 to 5 inches) in diameter graduated from 4 to 100 degrees C (40 to 212 degrees F), with two-degree graduations guaranteed accurate within one scale division. The socket shall be separable, double-seat, micrometer-fittings, with extension neck not less than 63 mm (2-1/2 inches) to clear tank or pipe covering. The thermometer shall be suitable for 19 mm (3/4 inch) pipe threads. Thermometers may be console-mounted with sensor installed in separate thermometer well.

2.7 SUPPORTS

A. Water heater stands shall be factory-fabricated steel for floor mounting capable of supporting water heater and water a minimum of 457 mm (18 inches) above the floor.

B. Wall brackets for wall mounted heaters shall be factory-fabricated steel capable of supporting water heater and water.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Water heaters shall be installed on concrete bases unless elevated above the floor. Refer to Section 03 30 00, CAST-IN-PLACE CONCRETE and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

C. The water heaters shall be installed level and plumb and securely anchored.

D. The water heaters shall be installed and connected in accordance with manufacturer's written instructions with manufacturer's recommended clearances.

E. All pressure and temperature relief valves discharge shall be piped to nearby floor drains with air gap.

F. Thermometers shall be installed on the water heater inlet and outlet piping and shall be positioned such that they can be read by an operator or staff standing on floor or walkway.

G. The thermostatic control shall be set for a minimum setting of 60 degrees C (140 degrees F) for storage heaters.

H. Dielectric unions shall be provided if there are dissimilar metals between the water heater connections and the attached piping.

I. Provide vacuum breakers per ANSI Z21.22 on the inlet pipe if the water heater is bottom fed.

J. Shutoff valves shall be installed on the domestic water supply piping to the water heater and on the domestic hot water outlet piping.

K. All manufacturer's required clearances shall be maintained.

L. A combination temperature and pressure relief valve shall be installed at the top portion of the storage tank in accordance with manufacturer's recommendations. The sensing element shall extend into the tank. The relief valve outlet drain piping shall discharge by air gap into a floor drain.

M. Piping type heat traps shall be installed on the inlet and outlet piping of the electric domestic water heater storage tanks if not provided integrally with the tanks.

N. Water heater drain piping shall be installed as indirect waste to spill by air gap into open drains or over floor drains. Hose end drain valves shall be installed at low points in water piping for electric domestic water heaters without integral drains.

3.2 LEAKAGE TEST

A. Before piping connections are made, water heaters shall be tested with hydrostatic pressure of 1380 kPa (200 psig) and 1654 kPa (240 psig) for a unit with a MAWP of 1104 kPa (160 psig). Any domestic water heater leaking water shall be replaced with a new unit at no additional cost or time to the Government.

3.3 PERFORMANCE TEST

A. Ensure that all the remote water outlets are always tested to a minimum of 43 degrees C (110 degrees F) and a maximum of 49 degrees C (120 degrees F) water flow.

3.4 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. The tests shall include system capacity, control function, and alarm functions.

C. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

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SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 07 92 00, JOINT SEALANTS: Sealing between fixtures and other finish surfaces.

E. Section 08 31 13, ACCESS DOORS AND FRAMES: Flush panel access doors.

F. Section 10 21 13, TOILET COMPARTMENTS: Through bolts.

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

H. Section 22 13 00, FACILITY SANITARY AND VENT PIPING.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The American Society of Mechanical Engineers (ASME):

A112.6.1M-1997 (R2012)..... Supports for Off-the-Floor Plumbing Fixtures for Public Use

A112.19.1-2013 ..... Enameled Cast Iron and Enameled Steel Plumbing Fixtures

A112.19.2-2013 ..... Ceramic Plumbing Fixtures

A112.19.3-2008 ..... Stainless Steel Plumbing Fixtures

C. American Society for Testing and Materials (ASTM):

A276-2013a ..... Standard Specification for Stainless Steel Bars and Shapes

B584-2008 ..... Standard Specification for Copper Alloy Sand Castings for General Applications

D. CSA Group:

B45.4-2008 (R2013)..... Stainless Steel Plumbing Fixtures

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

AMP 500-2006..... Metal Finishes Manual

F. American Society of Sanitary Engineering (ASSE):

1016-2011 ..... Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations

G. NSF International (NSF):

14-2013 ..... Plastics Piping System Components and Related Materials

61-2013 ..... Drinking Water System Components – Health Effects

372-2011 ..... Drinking Water System Components – Lead Content

H. American with Disabilities Act (A.D.A)

I. International Code Council (ICC):

IPC-2015 ..... International Plumbing Code

1.4 SUBMITTALS

A. Submittals, including number of required copies, 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 40 00, PLUMBING FIXTURES”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, connections, and capacity.

D. Operating Instructions: Comply with requirements in Section 01 00 00, GENERAL REQUIREMENTS.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version on compact disc or DVD 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 Government 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 shall be provided, and a copy of them in AutoCAD 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 certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material or equipment containing a weighted average of greater than 0.25 percent lead is prohibited in any potable water system intended for human consumption, and 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.

B. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended.

2.2 STAINLESS STEEL

A. Corrosion-resistant Steel (CRS):

1. Plate, Sheet and Strip: CRS flat products shall conform to chemical composition requirements of any 300 series steel specified in ASTM A276.
2. Finish: Exposed surfaces shall have standard polish (ground and polished) equal to NAAMM finish Number 4.

B. Die-cast zinc alloy products are prohibited.

2.3 STOPS

A. Provide 1/4 turn "ball type" loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in solid-surface, wood and metal casework, laboratory furniture and pharmacy furniture. Locate stops centrally above or below fixture in accessible location.

B. Furnish keys for lock shield stops to the COR.

C. Supply from stops not integral with faucet shall be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.

D. Supply pipe from wall to valve stop shall be rigid threaded IPS copper alloy pipe, i.e. red brass pipe nipple, chrome plated where exposed.

2.4 ESCUTCHEONS

A. Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

2.5 LAMINAR FLOW CONTROL DEVICE

A. Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing. **Aerators are prohibited.**

B. Flow Control Restrictor:

1. Capable of restricting flow from 32 ml/s to 95 ml/s (0.5 gpm to 1.5 gpm) for lavatories or as specified.
2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 170 kPa and 550 kPa (25 psig and 80 psig).
3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-cleaning action, and is capable of easy manual cleaning.

2.6 CARRIERS

A. ASME A112.6.1M, lavatory carrier for thin wall construction. All lavatory chair carriers shall be capable of supporting the lavatory with a 250-pound vertical load applied at the front of the fixture.

B. Where lavatories are installed back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers. The drainage fitting of the back to back carrier shall be so constructed that it prevents the discharge from one fixture from flowing into the opposite fixture.

2.7 WATER CLOSETS

A. (P-106) Water Closet (Tank Type, pressure assisted, ASME A112.19.2) domestic, elongated bowl with tank, closed coupled, flushometer tank, floor outlet. Top of seat shall be 450 mm (18 inches) above finished floor.

1. Seat: Domestic with cover, solid molded plastic, elongated bowl. Color shall be white.
2. Fittings: Tank fittings and accessories;
   a. Flushing mechanism shall be: Pressure assisted, close coupled, flushometer tank, 6 L (1.6 gallons) per flush.
   b. Stops, tank-angle.

2.8 LAVATORIES

A. Dimensions for lavatories are specified, Length by width (distance from wall) and depth.

B. Brass components in contact with water shall contain no more than 0.25 percent lead content by dry weight. Faucet flow rates shall be 3.9 L/m (1.5 gpm) for private lavatories and either 1.9 L/m (0.5 gpm) or 1.0 liter (0.25 gallons) per cycle for public lavatories.

C. (P-418) Lavatory (Wrist Control, ASME A112.19.2) straight back, approximately 508 mm by 457 mm (20 inches by 18 inches) and a 102 mm (4 inches) minimum apron, first quality vitreous china. Punching for faucet shall be on 203 mm (8 inches) centers. Set rim 864 mm (34 inches) above finished floor.

1. Faucet: Solid cast brass construction with washerless ceramic mixing cartridge type and centrally exposed rigid gooseneck spout with outlet 102 mm to 127 mm (4 inches to 5 inches) above rim. Provide laminar flow control device. One hundred two millimeter (4-inch) wrist blade type, handles on faucets shall be cast, formed or drop forged copper alloy. Faucet, wall and floor escutcheons shall be either copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall be chrome plated with a smooth bright finish.
2. Drain: Cast or wrought brass with flat grid strainer, offset tailpiece, chrome plated.
3. Stops: Angle type. See paragraph “Stops”.
4. Trap: Cast copper alloy, 38 mm by 32 mm (1 1/2 inches by 1 1/4 inches) P-trap. Adjustable with connected elbow and 1.4 mm thick (17 gauge) tubing extension to wall. Exposed metal trap surface, and connection hardware shall be chrome plated with a smooth bright finish. Set trap parallel to the wall.
5. Provide cover for exposed piping, drain, stops and trap per A.D.A.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.

B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.

C. Through Bolts: For free standing marble and metal stud partitions refer to Section 10 21 13, TOILET COMPARTMENTS.

D. Toggle Bolts: For hollow masonry units, finished or unfinished.

E. Expansion Bolts: For brick or concrete or other solid masonry. Shall be 6 mm (1/4 inch) diameter bolts, and to extend at least 76 mm (3 inches) into masonry and be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.

F. Power Set Fasteners: May be used for concrete walls, shall be 6 mm (1/4 inch) threaded studs, and shall extend at least 32 mm (1 1/4 inches) into wall.

G. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.

H. Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.

I. Aerators are prohibited on lavatories.

J. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost or additional time to the Government.

3.2 CLEANING

A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

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SECTION 23 05 11
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 23, HEATING, VENTILATING, AND AIR CONDITIONING (HVAC).

B. All drawings and Specifications shall be carefully studied during the course of bidding. Any perceived errors, omissions or discrepancies shall be referred immediately to the Contracting Officer for interpretation or correction.

C. 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.

D. 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. CHS: 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. GCS: Chilled Glycol Water Supply

58. GCR: Chilled Glycol Water Return
59. GHS: 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. HWS: Hot Water Heating Supply
70. HWR: 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 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
F. Section 03 30 00, CAST-IN-PLACE CONCRETE.
G. Section 05 31 00, STEEL DECKING.
H. Section 05 36 00, COMPOSITE METAL DECKING.
I. Section 05 50 00, METAL FABRICATIONS.
J. Section 07 84 00, FIRESTOPPING.
K. Section 07 92 00, JOINT SEALANTS.
L. Section 09 91 00, PAINTING.
M. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
N. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
O. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
P. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.
Q. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
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-Conditioning, Heating, and Refrigeration Institute (AHRI):
430-2020 ..... Performance Rating of Central Station Air-Handling Unit Supply Fans

C. Air Movement and Control Association (AMCA):
410-1996 ..... Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans

D. 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-2021 Welding, Brazing, and Fusing Qualifications

E. American Society for Testing and Materials (ASTM):
A36/A36M-2019 ..... Standard Specification for Carbon Structural Steel

A575-1996(2020) ..... Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

F. 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

G. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.(MSS):

SP-58-2018..... 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

H. Military Specifications (MIL):

MIL-P-21035B-2021..... Paint High Zinc Dust Content, Galvanizing Repair (Metric)

I. National Fire Protection Association (NFPA):

70-2020 ..... National Electrical Code (NEC)

101-2021 ..... Life Safety Code

J. Department of Veterans Affairs (VA):

PG-18-10-2020(R2022)..... Physical Security and Resiliency Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 05 11, COMMON WORK RESULTS FOR HVAC”, with applicable paragraph identification.

C. If the project is phased submit complete phasing plan/schedule with manpower levels prior to commencing work. The phasing plan shall be detailed enough to provide milestones in the process that can be verified.

D. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance or calibration 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. Mock-ups: Mock-ups are required for critical items and typical component installations replicated numerous times throughout the project as indicated in the individual Division 23 sections. The COR and VAMC representatives shall review and approve the mock-up prior to installation of additional applicable components.

J. Coordination (Layout) Drawings:

1. Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas. In addition to MEP systems and building structural systems, coordination drawings shall include above ceiling specialty systems such as pneumatic tube systems and patient track lifts along with associated structure.
2. Each Sub-Contractor is required by their respective specifications to prepare their own electronic coordination drawings using common backgrounds obtained from the Architect and Structural Engineer. The Division 23 Contractor shall be responsible for consolidating (merging) the drawings from all Sub-Contractors into combined coordination drawings, and shall lead the conflict resolution process with all Sub-Contractors working together to obtain

finished coordinated drawings/fabrication drawings. No work shall be installed, nor equipment purchased, until all Sub-Contractors have approved and signed-off with their approval, and the coordination drawings have been submitted and reviewed by the Engineer and VA. Review by the Engineer and VA is cursory. It is the Contractors responsibilities to ensure that all work is coordinated, including fit above ceilings (in MERs, service vestibules, etc.), and that specified ceiling heights are maintained.

3. The coordination 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, ductwork, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed coordination drawings of all piping and duct systems. The drawings shall 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.
4. Do not install equipment foundations, equipment or piping until coordination drawings have been approved.
5. In addition, for HVAC systems, provide details of the following:
   a. Mechanical equipment rooms.
   b. Interstitial space.
   c. Hangers, inserts, supports, and bracing.
   d. Pipe sleeves.
   e. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

K. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity. Submit under the pertinent section rather than under this section.
1. Submit belt drive with the driven equipment.
2. Submit electric motor data and variable speed drive data with the driven equipment.
   a. Variable speed drive data for motors shall be submitted under the appropriate Division 26 Specification Section. Coordinate requirements with EC.
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.

L. 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.

M. HVAC Maintenance Data and Operating Instructions:
   1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, paragraph INSTRUCTIONS for systems and equipment.
   2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
      a. Include complete list indicating all components of the systems.
      b. Include complete diagrams of the internal wiring for each item of equipment.
      c. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.
   3. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply for equipment. Include in the listing for belts: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

1.5 QUALITY ASSURANCE

A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC.

B. Flow Rate Tolerance for HVAC Equipment: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

C. Equipment Vibration Tolerance:
   1. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Equipment shall be factory-balanced to this tolerance and re-balanced onsite, as necessary.
   2. After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

D. Products Criteria:
   1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However,

digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.

2. Refer to all other sections for quality assurance requirements for systems and equipment specified therein.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 23 sections shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments shall be enforced, along with requirements of local utility companies. The most stringent requirements of these specifications, local codes, or utility company requirements shall always apply. Any conflicts shall be brought to the attention of the COR.
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be of the same manufacturer and model number, or if different models are required they shall be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Use of asbestos products or equipment or materials containing asbestos is prohibited.

E. HVAC Equipment Service Providers: Service providers shall be authorized and trained by the manufacturers of the equipment supplied. These providers shall be capable of responding onsite and provide acceptable service to restore equipment operations within 4 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shutdown of equipment; or within 24 hours in a non-emergency. Submit names, mail and e-mail addresses and phone numbers of service personnel and companies providing service under these conditions for (as applicable to the project): fans, air handling units, chillers, cooling towers, control systems, pumps, critical instrumentation, computer workstation and programming.

F. HVAC Mechanical Systems Welding: Before any welding is performed, Contractor shall submit a certificate certifying that welders comply with the following requirements:

1. HVAC mechanical systems welding shall meet ASME BPVC Section IX. Provide proof of current certification.
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".

3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
4. All welds shall be stamped according to the provisions of the AWS or ASME as required herein and by the associated code.

G. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR with submittals. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material and removal by the Contractor at 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 portable ladders or permanent platforms.. Examples of these items include 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 drawings shall be required in accordance with paragraph SUBMITTALS. Construction work shall not start on any system until the coordination drawings have been approved by VA.
4. Provide access panels (ceiling, wall, etc.) as required for any items that are inaccessible and require access, such as for operating, cleaning, servicing, maintenance, and calibration.
5. Workmanship/craftsmanship shall 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.
   a. All utilities shall be installed in a first class manor (level [unless required to be sloped], plumb, clean, neat, parallel to building lines, etc.)

I. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

J. Guaranty: Warranty of Construction, FAR Clause 52.246-21.

K. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specification section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

L. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.
2. Large equipment such as boilers, chillers, cooling towers, fans, and air handling units if shipped on open trailer trucks shall be covered with shrink on plastics or water proof tarpaulins that provide protection from exposure to rain, road salts and other transit hazards. Protection shall be kept in place until equipment is moved into a building or installed as designed.
3. Repair damaged equipment in first class, new operating condition and appearance; or, replace same as determined and directed by the COR. Such repair or replacement shall be at no additional cost or time to the Government.
4. Protect interiors of new equipment, ductwork and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing in operation.
5. Existing equipment, ductwork 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, ductwork 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. 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. 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 shall 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 all relevant information such as breaker location and numbers, and valve tag numbers. 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, 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.

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. Utility Service Interruptions (Chilled Water, Steam and Condensate, etc.): Limited utility service interruptions, as required for interconnections of new and existing systems, will be permitted by the COR during periods when the demands are not critical to the operation of the VAMC. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least 10 working days advance notice to the COR. The request shall include a detailed plan on the proposed shutdown and the intended work to be done along with manpower levels. All equipment and materials shall be onsite and verified with plan 5 days prior to the shutdown or it will need to be rescheduled.

D. Phasing of Work: Comply with all requirements shown on contract documents. Contractor shall submit a complete detailed phasing plan/schedule with manpower levels prior to commencing work. The phasing plan shall be detailed enough to provide milestones in the process that can be verified.

E. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA. Maintain all egress routes and safety systems/devices.

F. Acceptance of Work for Government Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Government, inspections will be made and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

G. Temporary Facilities: Refer to paragraph TEMPORARY PIPING AND EQUIPMENT in this section.

PART 2 - PRODUCTS

2.1 FACTORY ASSEMBLED PRODUCTS

A. Provide maximum standardization of components to reduce spare part requirements.

B. Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.

3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Equipment and components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, shall be the same make and model. Exceptions must be approved by the VA, but may be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 V-BELT DRIVES

A. Type: ARPM standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

B. Dimensions, Rating and Selection Standards: ARPM IP-20 and ARPM IP-21.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ARPM service factor (not less than 20 percent) in addition to the ARPM allowances for pitch diameter, center distance, and arc of contact.

D. Maximum Speed: 25 m/s (5000 feet per minute).

E. Adjustment Provisions: For alignment and ARPM standard allowances for installation and take-up.

F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.

G. Multiple Belts: Matched to ARPM specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:
1. Material: Pressed steel, or close-grained cast-iron.
2. Bore: Fixed or bushing type for securing to shaft with keys.
3. Balanced: Statically and dynamically.
4. Groove spacing for driving and driven pulleys shall be the same.

I. Drive Types, Based on AHRI 430:
   1. Provide adjustable-pitch or fixed-pitch drive as follows:
      a. Fan Speeds Up To 1800 RPM: 7.5 kW (10 horsepower) and smaller.
      b. Fan Speeds Over 1800 RPM: 2.2 kW (3 horsepower) and smaller.
   2. Provide fixed-pitch drives for drives larger than those listed above.
   3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling the design air flow branch, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

J. Final Drive Set: If adjustment is required beyond the capabilities of the factory drive set, the final drive set shall be provided as part of this contract at no additional cost or time to the Government.

2.4 SYNCHRONOUS BELT DRIVES

A. Type: ARPM synchronous belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

B. Dimensions, Rating and Selection Standards: ARPM IP-24 and ARPM IP-27.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ARPM service factor (not less than 20 percent) in addition to the ARPM allowances for pitch diameter, center distance, and arc of contact.

D. Maximum Speed: 25 m/s (5000 feet per minute).

E. Adjustment Provisions: For alignment and ARPM standard allowances for installation and take-up.

F. Drives may utilize a single belt of manufacturer's standard width for the application.

G. Multiple Belts: Matched to ARPM specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:
   1. Material: Pressed steel, or close-grained cast-iron.
   2. Bore: Fixed or bushing type for securing to shaft with keys.
   3. Balanced: Statically and dynamically.

I. Final Drive Set: The final fan speeds required to just meet the system CFM and pressure requirements, without throttling the design air flow branch, shall be determined by fan law calculation. If adjustment is required beyond the capabilities of the factory drive set, the final drive set shall be provided as part of this contract at no additional cost or time to the Government.

2.5 DRIVE GUARDS

A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the

floor to prevent damage to equipment and injury to personnel. Drive guards may be excluded where motors and drives are inside factory-fabricated air handling unit casings.

B. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gauge sheet steel; all edges shall be hemmed and ends shall be bent into flanges and the flanges shall be drilled and attached to pump base with minimum of four 6 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

C. V-belt and sheave assemblies shall be totally enclosed, firmly mounted, non-resonant. Guard shall be an assembly of minimum 22-gauge sheet steel and expanded or perforated metal to permit observation of belts. 25 mm (1 inch) diameter hole shall be provided at each shaft centerline to permit speed measurement.

D. Materials: Sheet steel, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.

E. Access for Speed Measurement: 25 mm (1 inch) diameter hole at each shaft center.

2.6 LIFTING ATTACHMENTS

A. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.7 ELECTRIC MOTORS

A. All material and equipment furnished, and installation methods shall conform to the requirements of Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT; Section 26 29 11, MOTOR CONTROLLERS; and, Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient premium efficiency type motors as scheduled.

2.8 VARIABLE SPEED MOTOR CONTROLLERS

A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, MOTOR CONTROLLERS for specifications.

B. Coordinate variable speed motor controller communication protocol with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

C. Provide variable speed motor controllers with or without a bypass contactor as indicated in the contract documents.

D. The motor shall be provided by the manufacturer of the driven equipment, such as pumps and fans. Variable speed motor controllers are specified in Section 26 29 11 MOTOR CONTROLLERS and shall be provided by the Division 26 Contractor. The combination of the controller and motor shall be compatible and shall be rated for 100 percent output performance.

HVAC Contractor shall coordinate motor and controller requirements with the Division 26 Contractor. Multiple units of the same class of equipment, i.e., air handlers, fans, pumps, shall be product of a single manufacturer.

E. Motors shall be premium efficiency type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.

F. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, nor shall be affected from other devices on the ac power system.

2.9 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown in the contract documents, and shown in the maintenance manuals. Identification for piping and ductwork is specified in Paragraph 3.8 below.

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 permanently fastened to the equipment. Identify unit components such as coils, filters, or fans.

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.
2. Valve Tags: Engraved black filled numbers and letters not less than 13 mm (1/2 inch) high for number designation, and not less than 6 mm (1/4 inch) for service designation on 19-gauge 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve Lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 279 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
4. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color-coded thumb tack in ceiling.

F. Ceiling Grid Labels:

1. 50 mm (2 inch) long by 13 mm (1/2 inch) wide by 0.025 mm (1 mil) thick UV resistant metalized polyester label with red border color and black custom lettering on white

background interior. Peel and stick adhesive backing. Label and adhesive manufactured specifically for use in equipment inventory tagging.

2. Custom print labels with above ceiling HVAC equipment numbers.

2.10 FIRESTOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer to Section 23 07 11, HVAC AND BOILER PLANT INSULATION, for firestop pipe and duct insulation.

2.11 GALVANIZED REPAIR COMPOUND

A. Mil-P-21035B, paint form.

2.12 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Vibration Isolators: Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

B. Supports for Roof Mounted Items:

1. Equipment: Equipment rails shall be galvanized steel, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory-installed 50 by 100 mm (2 by 4 inches) treated wood nailer, 1.3 mm (18 gauge) galvanized steel counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 279 mm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.
2. Pipe/Duct Pedestals: Provide a galvanized Unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.
3. Wind Load Analysis
   a. HVAC equipment, ductwork, piping, conduits, etc. exposed to wind shall have positive attachment to the building structure or ground to comply with wind load requirements of the International Building and Mechanical codes.
   b. Wind speed design shall be 120 MPH. Refer to structural drawings for additional design requirements.
   c. The contractor shall retain a specialty consultant to perform wind load calculations in accordance with the code and additional requirements specified in this Section. A professional engineer experienced in wind load attachment design and installation shall be responsible for calculations, attachment selections and installation details.
   d. The Wind Load Analysis consisting of attachment design, calculations, attachment selection, installation details including anchoring methods, fastener specifications, embedment and/or welded length, etc.shall be submitted for review and record. This submittal shall be signed and sealed by a professional engineer, as stated above. This

submittal will become part of the project design calculations, included in the project records, and when required, will be submitted to the authority having jurisdiction.

e. The wind load attachment design shall clearly indicate the attachment points to the building structure and design forces in all horizontal and vertical axes at the attachment points. The wind load attachment engineer shall coordinate all attachments with the projects structural engineer of record, who shall verify the attachment methods and the ability of the building structure to accept the loads imposed.

f. The wind load attachment design shall be based on actual equipment data (dimensions, weight, center of gravity, etc.) obtained from submittals or the manufacturers. The equipment manufacturer shall verify that the attachment points on the equipment can accept the combination of wind load, weight, and other loads imposed.

g. At the project Engineer of Record's discretion, equipment submittals may not be approved until the Wind Load Analysis has been submitted. It is the contractor's responsibility to schedule and coordinate the process in a timely fashion, including follow-up Wind Analysis submittals for equipment approved pending a Wind Analysis submittal.

h. Each manufacturer of equipment shall furnish a statement stamped by a professional engineer indicating that the equipment is designed and constructed to withstand wind loads required by the code. Statement shall be based on analysis, testing or experience data, and supporting documentation shall be available upon request.

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: Not permitted.

E. Attachment to Steel Building Construction:

1. Welded Attachment: MSS SP-58, Type 22.
2. Beam Clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp shall be used for individual copper tubing up to 22 mm (7/8 inch) outside diameter.

F. Attachment to Metal Pan or Deck (New Construction): As required for materials specified in Section 05 31 00, STEEL DECKING and Section 05 36 00, COMPOSITE METAL DECKING.

G. Attachment to Existing Structure: Support from existing floor/roof frame.

H. Attachment to Wood Construction: Wood screws or lag bolts.

I. 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 turnbuckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

J. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 by 41 mm (1-5/8 by 1-5/8 inches), 2.7 mm (12 gauge), designed to accept special spring held, hardened steel nuts. Trapeze hangers are prohibited for use for steam supply and condensate piping.
   1. Allowable Hanger Load: Manufacturers rating less 91 kg (200 pounds).
   2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13 mm (1/2 inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

K. 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 Supply and High and Medium Pressure Condensate Return (MSS SP-58):
      a. Standard Clevis Hanger: Type 1; provide locknut.
      b. Riser Clamps: Type 8.
      c. Wall Brackets: Types 31, 32 or 33.
      d. Roller Supports: Type 41, 43, 44 and 46.
      e. Saddle Support: Type 36, 37 or 38.
      f. Turnbuckle: Types 13 or 15. Preinsulate.
      g. U-bolt Clamp: Type 24.
      h. Copper Tube:
         1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non-adhesive isolation tape to prevent electrolysis.
         2) For vertical runs use epoxy painted or plastic-coated riser clamps.
         3) For Supporting Tube to Strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
         4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

i. Supports for Plastic Piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

3. High and Medium Pressure Steam Supply and High and Medium Pressure Condensate Return (MSS SP-58):
   a. Provide eye rod or Type 17 eye nut near the upper attachment.
   b. Piping 50 mm (2 inches) and Greater: Type 43 roller hanger. For roller hangers requiring seismic bracing provide a Type 1 clevis hanger with Type 41 roller attached by flat side bars.
   c. Piping with Vertical Expansion and Contraction:
      1) Movement Up To 19 mm (3/4 inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.
      2) Movement More Than 19 mm (3/4 inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.
4. Convertor and Expansion Tank Hangers: May be Type 1 sized for the shell diameter. Insulation where required shall cover the hangers.

L. Pre-Insulated Calcium Silicate Shields:
1. Provide 360-degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.
2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
3. Shield thickness shall match the pipe insulation.
4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
   a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
   b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS SP-58. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.
5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

2.13 PIPE PENETRATIONS

A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.

B. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For Sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
2. For Blocked Out Floor Openings: Provide 38 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For Drilled Penetrations: Provide 38 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

C. Penetrations through beams or ribs are prohibited but may be installed in concrete beam flanges. Any deviation from these requirements shall receive prior approval of COR.

D. Sheet Metal, Plastic, or Moisture-Resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

E. Cast-Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.

F. Galvanized Steel or an Alternate Black Iron Pipe with Asphalt Coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.

G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.14 DUCT AND PIPE PENETRATIONS

A. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 457 mm (18 inches) high with continuously welded seams, built-in cant strip, interior baffle with acoustic insulation, curb bottom, hinged curb adapter.

B. Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly. See section 07 84 00, FIRESTOPPING.

2.15 SPECIAL TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.

D. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the COR.

E. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.16 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 75 mm (3 inch pipe), 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.17 ASBESTOS

A. Materials containing asbestos are prohibited.

2.18 ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

A. Motors, starters, disconnects, devices, fuses, wiring and other electrical work shall be factory installed or furnished and field installed as specified in the various specification sections and as shown on the drawings. Refer to the project documents for requirements related to each trade. Coordinate all aspects of electrical components and wiring to complete the systems.

B. Equipment control panels containing power control components shall be marked with the minimum SCCR rating. The rating shall not be less than the available fault current. Refer to the electrical drawings for the calculated available fault at the distribution panel, MCC or panelboard serving the equipment. Include confirmation of being protected from the fault current in the equipment shop drawing submittal.

C. Note: Equipment with Electronically Commutated Motors (ECM's) are sometimes factory programmed to limit current draw to the motor, to limit the available brake horsepower to better match specified performance and reduce required power circuiting. This reduced brake horsepower is likely below the motor's nameplate rating. The electrical design documents be sized based on the ECM's nameplate motor horsepower. <u>The equipment supplier shall notify the Division 23 and 26 contractors and the Engineer if the maximum overcurrent protection on the design documents differs from their selected equipment's nameplate data.</u> Any required revisions

to the electrical circuiting, including maximum over-current protection devices, shall be documented on the shop drawing submittal. The required revisions shall be forwarded to the Division 26 contractor with enough time to adjust the over-current protection and the electric circuit installation. However, any additional cost associated with increased electrical feeder/breaker sizes or lack of coordination listed above shall be the Division 23 contractor's responsibility.

D. Refer to the Electrical drawings and verify adequacy of feeder size, sets of conductors and size, disconnecting means and other electrical requirements. Compare these to the requirements of the equipment to be furnished and report deficiencies and / or discrepancies to the Engineer in the bid period for resolution by addendum. Bear all costs for electrical changes where such issues are not properly resolved.

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 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 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, for maintenance and operation of all devices, all equipment items, valves, filters, strainers, transmitters, sensors, and control devices. All gauges and indicators shall be clearly visible by personnel standing on the floor or on portable ladders or permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown in the contract documents.

C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Cutting Holes:
   1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill is prohibited, except as permitted by COR where working area space is limited.
   2. Locate holes to avoid interference with structural members such as slabs, columns, ribs, beams or reinforcing. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
   3. Do not penetrate membrane waterproofing.
F. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but shall be provided.
G. Electrical Interconnection of Instrumentation or Controls: This generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Devices shall be located so they are easily accessible for testing, maintenance, and calibration. The COR has the final determination on what is accessible and what is not. Comply with NFPA 70.
H. Protection and Cleaning:
   1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, shall be replaced.
   2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
I. Concrete and Grout: Use concrete and non-shrink grout 20 MPa (3000 psig) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
J. Install gauges, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gauges to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
K. Install steam piping expansion joints as per manufacturer’s recommendations.
L. Work in Existing Building:
   1. Perform as specified in paragraphs OPERATIONS AND STORAGE AREAS, paragraph ALTERATIONS, and paragraph RESTORATION of the Section 01 00 00, GENERAL

REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).

2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, paragraph OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.

M. 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. Provide access panels where required in building components such as ceilings, walls, or floors to provide access to all equipment and/or components that need to be balanced, adjusted, serviced or maintained.

3.3 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment, ducts, and piping.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of paragraph ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING apply.

C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.4 RIGGING

A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service requirements as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Government will check structure adequacy and advise Contractor of recommended restrictions.

E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Rigging plan and methods shall be referred to COR for evaluation prior to actual work. Follow approved rigging plan.

G. Restore building to original condition upon completion of rigging work.

3.5 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels designed by a structural engineer, secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the COR.

B. Use of chain pipe supports; wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above are prohibited. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 13 mm (1/2 inch) clearance between pipe or piping covering and adjacent work.

D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-58. Provide additional supports at valves, strainers, inline pumps and other heavy components. Provide a support within one foot of each elbow.

E. HVAC Vertical Pipe Supports:

1. Up to 152 mm (6 inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.

2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.

F. Overhead Supports:
1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
3. Tubing and capillary systems shall be supported in channel troughs.

G. Floor Supports:
1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Chiller foundations shall have horizontal dimensions that exceed chiller base frame dimensions by at least 152 mm (6 inches) on all sides. Structural contract documents shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.

3.6 MECHANICAL DEMOLITION

A. Rigging access, other than indicated in the contract documents, shall be provided by the Contractor after approval for structural integrity by the COR. Such access shall be provided without additional cost or time to the Government. 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, fans, motors, steel and cast-iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump and fan manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats. This may include painting exposed metals where hangers were removed or where equipment was moved or removed.
6. Paint shall withstand the following temperatures without peeling or discoloration:
   a. Condensate: 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: Pipe marking shall be applied to all pipes after insulation and painting has been completed, and shall be as follows:
   1. Plastic semi-rigid snap-on type, manufacturer's standard pre-printed color-coded pipe markers extending fully around the pipe and insulation or pressure sensitive vinyl markers.
   2. On piping and insulation 6" and greater diameter, full band as specified above or strip-type markers fastened to the pipe or insulation with laminated or bonded application or by color-coded plastic tape not less than 1.50" wide, full circle at both ends of the marker.
   3. Arrows for direction of flow provided integral with the pipe marker or separate at each marker.

D. Duct Identification: Duct marking shall be applied to all ducts after insulation and painting has been completed, and shall be as follows:
   1. Laminated plastic color-coded pressure sensitive vinyl tape, 2.50” width, 3 mils minimum thickness. Identification shall include service (supply, return, exhaust, outside air) and direction of flow.
   2. Duct access panel markings shall be similar to duct markings to identify the device (fire damper, smoke damper, control damper, or smoke detector).
   3. Arrows for direction of flow provided integral with the duct marker or separate at each marker.
E. For pipe and duct labeling, coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled on drawings. Pipe and duct markings shall be placed:
   1. At each piece of equipment.
   2. At 25 ft. centers in mechanical rooms and concealed spaces, but at least once per room.
   3. At 50 ft. centers in other exposed locations.
   4. On mains at each branch take-off.
   5. On duct access panels.
F. Attach ceiling grid label on ceiling grid location directly underneath above ceiling air terminal, control system component, valve, filter unit, fan or other equipment that may require maintenance.

3.9 MOTOR AND DRIVES

A. Use synchronous belt drives only on equipment controlled by soft starters or variable frequency drive motor controllers without a bypass contactor. Use V-belt drives on all other applications.
B. Alignment of V-Belt Drives: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.
C. Alignment of Synchronous Belt Drives: Set driving and driven shafts parallel and align so that the corresponding pulley flanges are in the same plane.
D. Alignment of Direct-Connect Drives: Securely mount motor in accurate alignment so that shafts are per coupling manufacturer’s tolerances when both motor and driven machine are operating at normal temperatures.

3.10 LUBRICATION

A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. Field-check all devices for proper lubrication.
B. All devices and equipment shall be equipped with required lubrication fittings or devices. A minimum of 0.95 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application shall be provided; also provide 12

grease sticks for lubricated plug valves. Deliver all materials to COR in unopened containers that are properly identified as to application.

C. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

D. All lubrication points shall be extended to one side of the equipment.

3.11 STARTUP, TEMPORARY OPERATION AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and Contractor testing of selected equipment. Coordinate the startup and Contractor testing schedules with COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

D. Startup of equipment shall be performed as described in equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, paragraph TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.12 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS paragraph TESTS, and in individual Division 23 sections and submit the test reports and records to the COR.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost or time to the Government.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work. Rescheduling of these tests shall be requested in writing to COR for approval.

D. No adjustments shall be made during the acceptance inspection. All adjustments shall have been made by this point.

3.13 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.

3.14 EQUIPMENT SUPPORTS

A. Attachment to manufactured trusses, joists, purlins, and other engineered structural members and supports shall be done in strict accordance with the structural engineer's or manufacturer's recommendations. Refer to the architectural and structural drawings for type of engineered structural systems being used. Connections to these structural members shall be made with connection devices and methods approved by the structural engineer or manufacturer. Provide additional supports with supplemental steel shapes when spacing between structural members exceeds specified distances. In the case of existing trusses, the structural engineer must review and approve hanger attachment methods.

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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 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

F. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

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 ..... 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 (R2019) ..... 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 ..... 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.

1.5 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 MOTORS

A. For alternating current, fractional and integral horsepower motors, NEMA MG 1 and NEMA MG 2 shall apply.

B. For severe duty TEFC motors, IEEE 841 shall apply.

C. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 29 11, MOTOR CONTROLLERS; and Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors. Unless otherwise specified for a particular application, use electric motors with the following requirements.

D. Single-phase Motors:
   1. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.
      a. In order to meet ASHRAE 90.1 requirements, motors for small packaged HVAC equipment may be Electrically Commutated motor (EC type). Motor shall be brushless DC type specifically designed for applications with heavy duty ball bearings and electronic communication. The motor shall be speed controllable down to 20 percent of full speed and 85 percent efficient at all speeds.

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.
   1. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time-delay (20 seconds minimum) relay for switching from high to low speed.

F. Voltage ratings shall be as follows:
   1. Single phase:
      a. Motors connected to 120-volt systems: 115 volts.
      b. Motors connected to 208-volt systems: 200 volts.
      c. Motors connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
   2. Three phase:
      a. Motors connected to 208-volt systems: 200 volts.
      b. Motors, less than 74.6 kW (100 hp), connected to 240-volt or 480-volt systems: 208-230/460 volts, dual connection.

G. Number of phases shall be as follows:
   1. Motors, less than 373 W (1/2 hp): Single phase.
   2. Motors, 373 W (1/2 hp) and greater: 3 phase.
   3. Exceptions:
      a. Hermetically sealed motors.
      b. Motors for equipment assemblies, less than 746 W (1 hp), shall be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

H. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

I. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting, acceleration, and running torque without exceeding nameplate ratings or considering service factor.

J. Motor Enclosures:
   1. Shall be the NEMA types as specified and/or shown in the contract documents.
   2. Where the types of motor enclosures are not shown in the contract documents, they shall be the NEMA types per NEMA 250, which are most suitable for the environmental conditions where the motors are being installed. Enclosure requirements for certain conditions are as follows:
      a. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.
      b. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.
      c. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.
   3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

K. Electrical Design Requirements:
   1. Motors shall be continuous duty.
   2. The insulation system shall be rated minimum of Class B, 130 degrees C (266 degrees F).
   3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80 degrees C (176 degrees F).
   4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
   5. Motors shall be suitable for full voltage starting, unless otherwise noted. Coordinate motor features with applicable motor controllers.
   6. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General-Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both, or NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors.

L. Mechanical Design Requirements:
   1. Bearings shall be rated in accordance with ABMA 9 or ABMA 11 for a minimum fatigue life of 26,280 hours for belt-driven loads and 100,000 hours for direct-drive loads based on L10 (Basic Rating Life) at full load direct coupled, except vertical high thrust motors which require a 40,000 hours rating. A minimum fatigue life of 40,000 hours is required for VFD drives.

2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30 percent of normal down thrust.
3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
4. Grease fittings, if provided, shall be Alemite type or equivalent.
5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 3.8 mm (0.15 inch) per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.
8. Motors on 180 frames and greater shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
9. All external fasteners shall be corrosion resistant.
10. Condensation heaters, when specified, shall keep motor windings at least 5 degrees C (9 degrees F) above ambient temperature.
11. Winding thermostats, when specified shall be normally closed, connected in series.
12. Grounding provisions shall be in the main terminal box.

M. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional cost or time to the Government.
2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
   b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
   c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.
4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated “inverter-duty” per NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors. Provide motor shaft grounding apparatus that shall protect bearings from damage from stray currents.

N. Additional requirements for specific motors, as indicated in the other sections listed in Article, RELATED SECTIONS shall also apply.

O. NEMA Premium Efficiency Electric Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 W (1 hp) or more shall meet the minimum full-load efficiencies as indicated in the following table. Motors of 746 W (1 hp) or more with open, drip-proof, or TEFC enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Premium Efficiencies Open Drip-Proof				**Minimum Premium Efficiencies Totally Enclosed Fan-Cooled (TEFC)**			
Rating kW (hp)	**1200 RPM**	**1800 RPM**	**3600 RPM**	**Rating kW (hp)**	**1200 RPM**	**1800 RPM**	**3600 RPM**
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

P. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM, and 3600 RPM. Power factor correction capacitors shall be provided unless the motor meets the 0.90 requirement without it or if the motor is controlled by a variable frequency drive. The power

factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

Q. Energy Efficiency of Small Motors (Motor Efficiencies): All motors under 746 W (1 hp) shall meet the requirements of the DOE Small Motor Regulation.

Polyphase Open Motors Average full load efficiency				**Capacitor-start capacitor-run and capacitor-start induction run open motors Average full load efficiency**			
Rating kW (hp)	**6 poles**	**4 poles**	**2 poles**	**Rating kW (hp)**	**6 poles**	**4 poles**	**2 poles**
0.18 (0.25)	67.5	69.5	65.6	0.18 (0.25)	62.2	68.5	66.6
0.25 (0.33)	71.4	73.4	69.5	0.25 (0.33)	66.6	72.4	70.5
0.37 (0.5)	75.3	78.2	73.4	0.37 (0.5)	76.2	76.2	72.4
0.55 (0.75)	81.7	81.1	76.8	0.55 (0.75)	80.2	81.8	76.2

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown in the contract documents and/or as required by other sections of these specifications.

B. If in the substantiated evaluation of the COR, the installation fails to meet the requirements of the construction documents with respect to function and maintainability, an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 FIELD TESTS

A. All tests shall be witnessed by the CxA or by the COR.

B. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before startup. All shall test free from grounds.

C. Perform Load test in accordance with IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.

D. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

E. All test data shall be complied into a report form for each motor and provided to the contracting officer or their representative.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA shall observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

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 23 05 41
NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the application of noise control measures, tolerance and vibration isolation for HVAC work, and vibration control techniques to boiler plant rotating equipment and parts including chillers, cooling towers, boilers, pumps, fans, compressors, motors, and steam turbines.

B. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Section 23 31 00, HVAC DUCTS and CASINGS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. American Society of Civil Engineers (ASCE):
ASCE 7-2016 ..... Minimum Design Loads for Buildings and Other Structures

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
Handbook-2019 ..... ASHRAE Handbook – HVAC Applications
Handbook-2021 ..... ASHRAE Handbook - Fundamentals, Chapter 8, Sound and Vibration

D. American Society for Testing and Materials (ASTM):
A123/A123M-2017 ..... Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A307-2021 ..... Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
B117-2019 ..... Standard Practice for Operating Salt Spray (Fog) Apparatus
D2240-2015(R2021) ..... Standard Test Method for Rubber Property - Durometer Hardness

E. International Code Council (ICC):
IBC-2021 ..... International Building Code

F. Manufacturers Standardization Society (MSS):

SP-58-2018..... Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

G. Occupational Safety and Health Administration (OSHA):

29 CFR 1910.95..... Occupational Noise Exposure

H. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):

001-2008 ..... Seismic Restraint Manual: Guidelines for Mechanical Systems, 3rd Edition

I. Department of Veterans Affairs (VA):

H-18-8-2019(R2020) ..... Seismic Design Requirements

PG-18-10-2017(R2021)..... HVAC Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Vibration isolators:
   a. Floor mountings
   b. Hangers
   c. Snubbers
   d. Thrust restraints
2. Bases.
3. Acoustical enclosures.

D. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.

E. The supplier of isolation equipment shall study the application, the equipment to be isolated and the structure. The supplier shall assume responsibility to determine optimum deflection characteristic accounting for dynamic and static forces.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

B. Noise Criteria:

1. Perform an acoustic analysis to demonstrate that the specified room noise levels are achieved in all octave bands for all air-handling units, heating and ventilating units, fans, chillers, boilers, generators, and outdoor noise producing equipment, such as cooling towers and chillers. Refer to VA HVAC Design Manual Chapter 6 Room Data Sheets for the required Noise Criteria (NC) levels. If the necessary room type is not listed in Chapter 6 of VA HVAC Design Manual then consult the ASHRAE Handbook - HVAC Applications. The analysis shall consider both air duct borne noise and noise transmission through walls, floors and roofs and shall be completed for all duct systems and all HVAC equipment.
2. For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the foregoing noise criteria, local ordinance noise levels, and OSHA 29 CFR 1910.95 requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE Handbook - Fundamentals, Chapter 8, Sound and Vibration.
3. An allowance, not to exceed 5 db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.
4. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

C. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal, and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors shall be made at the mounting feet.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Type of isolator, base, and minimum static deflection shall be as required for each specific equipment application as recommended by isolator or equipment manufacturer. Refer to ASHRAE Handbook - HVAC Applications Chapter 49, Noise and Vibration Control, Table 47 for selection guide for Vibration Isolation.

B. Elastomeric isolators shall comply with ASTM D2240 and be oil resistant neoprene with a maximum stiffness of 60 durometer and have a straight-line deflection curve.

C. Exposure to Weather: Isolator housings to be either hot dipped galvanized or powder coated to ASTM B117 salt spray testing standards. Springs to be powder coated or electro galvanized. All hardware to be electro galvanized. In addition, provide limit stops to resist wind velocity. Velocity pressure established by wind shall be calculated in accordance with Section 1609 of the International Building Code. A minimum wind velocity of 75 mph shall be employed.

D. Uniform Loading: Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.

E. Color code isolators by type and size for easy identification of capacity.

2.2 VIBRATION ISOLATORS

A. Floor Mountings:

1. Double Deflection Neoprene (Type N): Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes.
2. Spring Isolators (Type S): Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.
3. Spring Isolators with Vertical Limit Stops (Type SP): Similar to spring isolators noted above, except include a vertical limit stop to limit upward travel if weight is removed and also to reduce movement and spring extension due to wind loads. Provide clearance around restraining bolts to prevent mechanical short circuiting. Isolators shall have a minimum seismic rating of one G.
4. Pads (Type D), Washers (Type W), and Bushings (Type L): Pads shall be natural rubber or neoprene waffle, neoprene and steel waffle, or reinforced duck and neoprene. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).

B. Hangers: Shall be combination neoprene and springs unless otherwise noted and shall allow for expansion of pipe.

1. Combination Neoprene and Spring (Type H): Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
2. Hanger supports for piping 50 mm (2 inches) and greater shall have a pointer and scale deflection indicator.

C. Snubbers: Each spring mounted base shall have a minimum of four all-directional or eight two directional (two per side) seismic snubbers that are double acting. Elastomeric materials shall be shock absorbent neoprene bridge quality bearing pads, maximum 60 durometer, replaceable and

have a minimum thickness of 6 mm (1/4 inch). Air gap between hard and resilient material shall be not less than 3.2 mm (1/8 inch) nor greater than 6 mm (1/4 inch). Restraints shall be capable of withstanding design load without permanent deformation.

D. Thrust Restraints (Type THR): Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow a maximum movement of 6 mm (1/4 inch) when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.

2.3 BASES

A. Rails (Type R): Design rails with isolator brackets to reduce mounting height of equipment and cradle machines having legs or bases that do not require a complete supplementary base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension but not less than 100 mm (4 inches). Where rails are used with neoprene mounts for small fans or close coupled pumps, extend rails to compensate overhang of housing.

B. Inertia Base (Type I): Base shall be a reinforced concrete inertia base. Pour concrete into a welded steel channel frame, incorporating prelocated equipment anchor bolts and pipe sleeves. Level the concrete to provide a smooth uniform bearing surface for equipment mounting. Provide grout under uneven supports. Channel depth shall be a minimum of 1/12 of longest dimension of base but not less than 152 mm (6 inches). Form shall include 13 mm (1/2 inch) reinforcing bars welded in place on minimum of 203 mm (8 inch) centers running both ways in a layer 38 mm (1-1/2 inches) above bottom. Use height saving brackets in all mounting locations. Weight of inertia base shall be equal to or greater than weight of equipment supported to provide a maximum peak-to-peak displacement of 1.6 mm (1/16 inch).

C. Curb Mounted Isolation Base (Type CB): Fabricate from aluminum to fit on top of standard curb with overlap to allow water run-off and have wind and water seals which shall not interfere with spring action. Provide resilient snubbers with 6 mm (1/4 inch) clearance for wind resistance. Top and bottom bearing surfaces shall have sponge type weather seals. Integral spring isolators shall comply with Spring Isolator (Type S) requirements.

2.4 SOUND ATTENUATING UNITS

A. Refer to Section 23 31 00, HVAC DUCTS and CASINGS.

2.5 ACOUSTICAL ENCLOSURES IN MECHANICAL ROOMS

A. Provide where shown in the contract documents. Enclosures shall be removable and sectional, of a size and weight that sections can be readily handled with typical lifting and moving equipment available in the equipment room. Enclosures shall contain access openings, observation ports, lights, and ventilation where required for normal operation, observation and servicing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Vibration Isolation:

1. No metal-to-metal contact will be permitted between fixed and floating parts.
2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (like pumps, or compressors) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports with a deflection equal to that used on the corresponding equipment.
3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
4. Provide heat shields where elastomers are subject to temperatures over 38 degrees C (l00 degrees F).
5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
6. Non-rotating equipment such as heat exchangers and convertors shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.

C. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.

3.2 ADJUSTING

A. Adjust vibration isolators after piping systems are filled and equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Attach thrust limits at centerline of thrust and adjust to a maximum of 6 mm (1/4 inch) movement during start and stop.

D. Adjust active height of spring isolators.

E. Adjust snubbers according to manufacturer's recommendations.

G. Torque anchor bolts according to equipment manufacturer's recommendations.

3.3 SELECTION GUIDE FOR VIBRATION ISOLATORS

A. Select and size vibration isolators in accordance with Table 47, Chapter 49 of 2019 ASHRAE HVAC Applications Handbook on Sound and Vibration Control.

- - - E N D - - -

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:
   1. Planning systematic TAB procedures.
   2. Design Review Report.
   3. Systems Inspection Report.
   4. Duct Air Leakage Test Report.
   5. Systems Readiness Report.
   6. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
   7. Vibration and sound measurements.
   8. Recording and reporting results.
   9. Document critical paths of flow on reports.

C. During the bid period, call to attention any requirements for additional balancing dampers, test ports, gage cocks, thermometer wells, flow control devices, valves, balancing valves and fittings and manual volume dampers which are deemed necessary in addition to those shown on the drawings; and provide such so that proper balancing can be performed. Prior to installation of the systems, verify that the proper number and location of balancing devices are adequate for completion of the balancing work.

D. Definitions:
   1. Basic TAB used in this Section: Chapter 39, "Testing, Adjusting and Balancing" of ASHRAE Handbook "HVAC Applications".
   2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
   3. AABC: Associated Air Balance Council.
   4. NEBB: National Environmental Balancing Bureau.
   5. TABB: Testing Adjusting and Balancing Bureau.
   6. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.
   7. Hydronic Systems: Includes chilled water, heating hot water systems.
   8. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.

9. Flow Rate Tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
D. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
E. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.
F. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
G. Section 23 31 00, HVAC DUCTS AND CASINGS.

1.3 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.
B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
   2019 ..... ASHRAE Handbook – HVAC Applications, Chapter 39, Testing, Adjusting, and Balancing and Chapter 49, Noise and Vibration Control
C. Associated Air Balance Council (AABC):
   2016 ..... National Standards for Total System Balance, 7th Edition
D. National Environmental Balancing Bureau (NEBB):
   2019 ..... Procedural Standard for Testing, Adjusting, and Balancing of Environmental Systems, 9th Edition
   2015 ..... Procedural Standard for the Measurement of Sound and Vibration, 2nd Edition
   S110-2019 ..... Whole Building Technical Commissioning of New Construction, 2nd Edition
E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
   2002 ..... HVAC Systems Testing, Adjusting and Balancing, 3rd Edition
   2003 ..... TAB Procedural Guide 1st Edition

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 05 93, SECTION TITLE”, with applicable paragraph identification.

C. Submit names and qualifications of TAB agency and TAB Specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.

D. For use by the COR staff, submit one complete set of applicable AABC, NEBB or TABB publications that will be the basis of TAB work.

E. Submit the following for review and approval:

1. Design Review Report 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. Equipment Calibration Report.
6. Intermediate and Final TAB reports covering flow balance and adjustments, room pressure relationships, equipment calibration/comparison tests, performance tests, vibration tests and sound tests.

   a. All installation deficiencies shall coordinated with prime contractor and corrected prior to final reports.
7. Include in final reports applicable explanatory comments on test results that differ from design requirements.
8. Include in each report the critical path for each balanced branch (air and hydronic). Every branch shall have at least one terminal device damper 100 percent open.

F. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area with noted critical paths.

1.5 QUALITY ASSURANCE

A. Refer to paragraphs QUALITY ASSURANCE and SUBMITTALS, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

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. No individual entity shall be permitted to serve as both the HVAC Contractor and the TAB agency. In addition, the TAB agency shall not have any affiliation with the HVAC Contractor or any of its sub-contractors.
2. The TAB agency shall be either a certified member of AABC, NEBB, or TABB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the COR and submit another qualified TAB firm for approval. Any agency

that has been the subject of disciplinary action by either the AABC, TABB or NEBB within the five (5) years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.

3. TAB Specialist: The TAB Specialist shall be either a member of AABC or TABB or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the COR and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five (5) years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB Specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and shall be performed by an approved successor.
4. TAB Specialist shall be identified by the General Contractor within sixty (60) days after the Notice to Proceed. The TAB Specialist will be coordinating, scheduling, and reporting all TAB work and related activities and shall provide necessary information as required by the COR. The responsibilities shall specifically include:
   a. Directly supervising all TAB work.
   b. Sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC, TABB or NEBB.
   c. Following all TAB work through its satisfactory completion.
   d. Providing final markings of settings of all HVAC adjustment devices.
   e. Permanently mark location of duct test ports.
   f. Documenting critical paths from the fan or pump. These critical paths are ones in which are 100 percent open from the fan or pump to the terminal device. This will show the least amount of restriction is being imposed on the system by the TAB firm.
5. All TAB technicians performing actual TAB work shall be experienced and shall have done satisfactory work on a minimum of three (3) projects comparable in size and complexity to this project. Qualifications shall be certified by the TAB agency in writing. The lead technician shall be certified by AABC, TABB or NEBB.

C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards, TABB/SMACNA International Standards, or by NEBB

Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose. All equipment shall remain in calibration, or be re-calibrated if certification expires, during the TAB procedures.

D. TAB Criteria:

1. One or more of the applicable AABC, NEBB, TABB or SMACNA publications, supplemented by Chapter 39, "Testing, Adjusting and Balancing" of ASHRAE Handbook "HVAC Applications" and requirements stated herein shall be the basis for planning, procedures, and reports.
2. Flow Rate Tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow Chapter 39, "Testing, Adjusting and Balancing" of ASHRAE Handbook "HVAC Applications" as a guideline. Air Filter resistance during tests, artificially imposed, if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.
   a. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 5 percent to plus l0 percent.
   b. Air Terminal Units (maximum values): Minus 5 percent to plus l0 percent
   c. Exhaust Hoods/Cabinets: 0 percent to plus l0 percent.
   d. Minimum Outside Air: 0 percent to plus 10 percent.
   e. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 5 percent to plus l0 percent except if the air to air space is 100 CFM or less the tolerance shall be minus 5 to plus 5 percent.
      1) Laminar supply air devices located in Operating Rooms (including C-section) and Procedure Rooms shall be balanced as indicated above but no less than an average velocity of 25 to 35 cfm per square foot. Velocities above or below this range at individual devices will not be accepted. Face velocities shall be included in the balance report.
   f. Heating Hot Water Pumps and Hot Water Coils: Minus 5 percent to plus 5 percent.
   g. Chilled Water and Condenser Water Pumps: Minus 5 percent to plus 5 percent.
   h. Chilled Water Coils: Minus 5 percent to plus 5 percent.
3. Systems shall be adjusted for energy efficient operation as described in PART 3.
4. Typical TAB procedures and critical path results shall be demonstrated to the COR for one air distribution system (including all fans, 3 terminal units, 3 rooms randomly selected by the COR, one of which shall be a critical path) and 1 hydronic system (pumps and coils) as follows:
   a. When field TAB work begins.

b. During each partial final inspection and the final inspection for the project if requested by VA.

PART 2 - PRODUCTS

2.1 PLUGS

A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

A. See Section 23 07 11, HVAC and BOILER PLANT INSULATION. Provide for repair of insulation removed or damaged for TAB work.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to TAB Criteria in Paragraph QUALITY ASSURANCE.

B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 DESIGN REVIEW REPORT

A. The TAB Specialist shall review the contract documents and advise the COR of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3 SYSTEMS INSPECTION REPORT

A. Inspect equipment and installation for conformance with design.

B. The inspection and report shall be done after air distribution and hydronic equipment is onsite and duct and piping installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

C. Reports: Follow checklist format developed by AABC, NEBB or SMACNA (TABB), supplemented by narrative comments, with emphasis on air-handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.4 DUCT AIR LEAKAGE TEST REPORT

A. TAB Agency shall perform the leakage test as outlined in "Duct Leakage Tests and Repairs" in Section 23 31 00, HVAC DUCTS and CASINGS for TAB agency’s role and responsibilities in witnessing, recording and reporting of deficiencies.

3.5 SYSTEM READINESS REPORT

A. The TAB Contractor shall measure existing air and water flow rates associated with existing systems utilized to serve renovated areas as indicated in the contract documents. Submit report of findings to COR.

B. Inspect each system to ensure that it is complete including installation and operation of controls. Submit report to COR in standard format and forms prepared and/or approved by the CxA.

C. Verify that all items such as ductwork piping, dampers, valves, ports, terminals, connectors, and flow controllers, that are required for TAB are installed. Provide a report to the COR.

3.6 TAB REPORTS

A. Submit an intermediate report for 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 or time to the government.

D. Do not proceed with the remaining systems until intermediate report is approved by the COR.

3.7 TAB PROCEDURES

A. TAB shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC, TABB or NEBB. Balancing shall be done proportionally to all applicable systems.

   1. At least 1 trunk damper shall be 100 percent open.
   2. At least 1 branch damper shall be 100 percent open per trunk.
   3. At least 1 terminal device duct shall be 100 percent open per branch.
   4. At least one hydronic balancing valve shall be 100 percent open per hydronic system.

B. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.

C. Coordinate TAB procedures with existing systems and any phased construction completion requirements for the project. Provide TAB reports for pre-construction air and water flow rate and for each phase of the project prior to partial final inspections of each phase of the project. Return existing areas outside the work area to pre-constructed conditions.

D. Allow sufficient time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.

E. Equipment Calibration/Comparison Tests: Include calibration and/or comparison information for each air flow measuring station and DDC room pressure sensor.

F. Air Balance and Equipment Test: Include air-handling units, fans, terminal units, fan coil units, and room diffusers/outlets/inlets.

1. Artificially load air filters by partial blanking to produce static air pressure drop of manufacturer's recommended change over pressure drop.
2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide new drive sets as required to adjust fan speeds.
3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other HVAC controls function properly.
4. Record final measurements for air handling equipment performance data sheets.
5. Record final damper settings for all manual volume dampers.

G. Rooms with Specific Pressure Relationships:

1. For rooms that require specific pressure relationships as noted in the contract documents report the following information:
   a. Room differential pressure at minimum and maximum flows.
   b. Room air changes per hour (ACH).
   c. Adjust airflows to achieve the required air pressure relationships. Increase/decrease the supply/exhaust airflow as needed. For positively pressurized rooms the supply airflow shall be set per the contract documents and return/exhaust airflow shall be adjusted to achieve the required pressure relationship. For negatively pressurized rooms the exhaust airflow per the contract documents and the supply airflow adjusted to achieve the required pressure relationship.

H. Water Balance and Equipment Test: Include circulating pumps, convertors and coils:

1. Coordinate water chiller flow balancing with Section 23 64 00, PACKAGED WATER CHILLERS.
2. Adjust flow rates for equipment. Set coils to values on equipment submittals, if different from values in the contract documents.
3. Primary-Secondary (variable volume) Systems: Coordinate TAB with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Balance systems at design water flow and then verify that variable flow controls function as designed.
4. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors.

Include entering and leaving air temperatures (DB/WB for cooling coils) for air-handling units and reheat coils. Make air and water temperature measurements at the same time.

5. On coils with automatic flow limiting valves (automatic balancing valves) measure and report Delta P across valve and measure Delta P across 100 percent open temperature control valve and using control valve CV calculate and report gpm.
6. Record final valve setting for all balancing valves.

3.8 VIBRATION TESTING

A. Furnish instruments and perform vibration measurements as specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Field vibration balancing is specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide measurements for all rotating HVAC equipment of 373 watts (1/2 horsepower) and larger, including pumps, fans and motors.

B. Record initial measurements for each unit of equipment on test forms and submit a report to the COR. Where vibration readings exceed the allowable tolerance Contractor shall be directed to correct the problem. The TAB agency shall verify that the corrections are done and submit a final report to the COR.

3.9 SOUND TESTING

A. Perform and record required sound measurements in accordance with paragraph QUALITY ASSURANCE in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
   1. Take readings in rooms, approximately ten (10) percent of all rooms. The COR may designate the specific rooms to be tested.

B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC, TABB or NEBB.

C. Sound reference levels, formulas and coefficients shall be according to ASHRAE Handbook "HVAC Applications", Chapter 49, “Noise and Vibration Control”.

D. Determine compliance with contract documents as follows:
   1. When sound pressure levels are specified, including the NC Criteria in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT:
      a. Reduce the background noise as much as possible by shutting off unrelated audible equipment.
      b. Measure octave band sound pressure levels with specified equipment "off."
      c. Measure octave band sound pressure levels with specified equipment "on."
      d. Use the DIFFERENCE in corresponding readings to determine the sound pressure due to equipment.

DIFFERENCE:	0	1	2	3	4	5 to 9	10 or More
FACTOR:	10	7	4	3	2	1	0

Sound pressure level due to equipment equals sound pressure level with equipment "on" minus FACTOR.

e. Plot octave bands of sound pressure level due to equipment for typical rooms on a graph which also shows noise criteria (NC) curves.

2. When sound power levels are specified:
   a. Perform steps 1.a. through 1.d., as specified above.
   b. For Indoor Equipment: Determine room attenuating effect, i.e., difference between sound power level and sound pressure level. Determined sound power level will be the sum of sound pressure level due to equipment plus the room attenuating effect.
   c. For Outdoor Equipment: Use directivity factor and distance from noise source to determine distance factor, i.e., difference between sound power level and sound pressure level. Measured sound power level will be the sum of sound pressure level due to equipment plus the distance factor. Use 9 meters (30 feet) for sound level location.
3. Where sound pressure levels are specified in terms of dB(A), measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.

E. Where measured sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the COR and the necessary sound tests shall be repeated.

F. Test readings for sound testing could go higher than 10 percent if determination is made by the COR based on the recorded sound data.

3.10 MARKING OF SETTINGS

A. Following approval of TAB Final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the COR.

3.11 IDENTIFICATION OF TEST PORTS

A. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

3.12 PHASING

A. Phased Projects: Testing and Balancing Work shall follow project with areas to be completed per the project phasing. Upon completion of the project, all areas shall have been tested and balanced per the contract documents. Additionally, upon completion of all phases, TAB

Contractor shall verify that balance of all air and water systems previously balanced under individual phases are still within tolerances specified in this section. Rebalance flows as required after all phases are complete and systems are fully operational to all spaces served.

B. Existing Areas: Systems that serve areas outside of the project scope shall not be adversely affected. Measure existing parameters where shown to document system capacity.

3.13 CRITICAL FLOW PATH

A. Provide a documented critical path for all fluid flows. There shall be at least one (1) terminal device that can be traced back to the fan or pump where there is no damper or valves that are less than 100 percent open.

- - E N D - -

SECTION 23 07 11
HVAC AND BOILER PLANT INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for
   1. HVAC piping, ductwork and equipment.
   2. Re-insulation of HVAC piping, ductwork and equipment after asbestos abatement.
   3. Unless noted otherwise below, exhaust and relief air ductwork shall be insulated from 24” upstream of the auto/backdraft damper to the point of exterior wall/roof penetration.
   4. Equipment and devices, accessories and stiffeners in insulated ductwork shall also be insulated. This includes items such as external duct bracing and stiffeners, duct coils, air terminal reheat box coils, air control dampers and valves, fire dampers, smoke dampers, filter housings, and sound attenuators. The backside of supply air diffusers shall also be insulated to prevent condensation, except if the air device is internally lined or factory insulated.
   5. Reinsulate piping, ductwork and equipment where existing insulation has been damaged or removed in the performance of work in this project.

B. Definitions
   1. ASJ: All service jacket, white finish facing or jacket.
   2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
   3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
   4. Concealed: Ductwork and piping above ceilings and in chases, and pipe spaces.
   5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
   6. FSK: Foil-scrim-kraft facing.
   7. Hot: HVAC Ductwork handling air at design temperature above 16 degrees C (60 degrees F); HVAC equipment or piping handling media above 41 degrees C (105 degrees F).
   8. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).
   9. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
   10. Thermal conductance: Heat flow rate through materials.
      a. Flat surface: Watt per square meter (BTU per hour per square foot).

b. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).

11. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.
13. HPS: High pressure steam (415 kPa [60 psig] and above).
14. HPR: High pressure steam condensate return.
15. MPS: Medium pressure steam (110 kPa [16 psig] thru 414 kPa [59 psig].
16. MPR: Medium pressure steam condensate return.
17. LPS: Low pressure steam (103 kPa [15 psig] and below).
18. LPR: Low pressure steam condensate gravity return.
19. PC: Pumped condensate.
20. HWS: Heating hot water supply.
21. HWR: Heating hot water return.
22. CHS: Chilled water supply.
23. CHR: Chilled water return.
24. 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 21 13, HYDRONIC PIPING.

E. 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 so as 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 run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

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

B. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
   a. Insulation materials: Specify each type used and state surface burning characteristics.
   b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
   c. Insulation accessory materials: Each type used.
   d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
   e. Make reference to applicable specification paragraph numbers for coordination.
   f. Submit summary table that includes description of products to be used on straights and fittings for each service and location, thermal characteristics, jackets thickness, etc.

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 (2)- 1999 ..... Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

C. Military Specifications (Mil. Spec.):

MIL-A-3316C (2)-1987 ..... Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (1)-2016..... Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-C-19565C (1)-2016 ..... 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):

A167-99 2014 ..... Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

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

C449-2019 ..... Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

C533-2017 ..... Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534-2017 ..... Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547-2017 ..... Standard Specification for Mineral Fiber pipe Insulation

C552-07 ..... Standard Specification for Cellular Glass Thermal Insulation

C553-2015 ..... Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C585-2016 ..... Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System) R (1998)

C612-2014 ..... Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126-2019 ..... Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-2017 ..... Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

D1668-97a 2017 ..... Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-2014 ..... Standard Test Method for Surface Burning Characteristics of Building
Materials

E119-2007 ..... Standard Test Method for Fire Tests of Building Construction and Materials

E136-2019 ..... 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-2018 ..... Standard for the Installation of Air Conditioning and Ventilating Systems

96-2018 ..... Standard~~s~~ for Ventilation Control and Fire Protection of Commercial Cooking Operations

101-2018 ..... Life Safety Code

251-2014 ..... Standard methods of Tests of Fire Endurance of Building Construction Materials

255-2006 ..... Standard Method of tests of Surface Burning Characteristics of Building Materials

F. Underwriters Laboratories, Inc (UL):

723-2018 ..... UL Standard for Safety Test for Surface Burning Characteristics of Building Materials with Revision of 09/08

G. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS):

SP58-2018..... Pipe Hangers and Supports Materials, Design, and Manufacture

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m^3 (3 pcf), k = 0.037 (0.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 121 degrees C (250 degrees F) with foil scrim (FSK) facing.

B. ASTM C553 (Blanket, Flexible) Type I, Class B-3, Density 16 kg/m^3 (1 pcf), k = 0.045 (0.31) at 24 degrees C (75 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with foil scrim (FSK) facing.

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

2.2 RIGID CELLULAR PHENOLIC FOAM

A. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

B. Equipment and Duct Insulation, ASTM C 1126, type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket.

2.3 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

A. ASTM C177, C518, k = 0.039 (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

2.4 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance $\underline{=}$ 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 conveying

fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

E. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.

F. Factory composite materials may be used provided that they have been tested and certified by the manufacturer.

G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-535, 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.

2.5 REMOVABLE INSULATION JACKETS

A. Removable insulation jackets shall be provided for all valves (including all air terminal unit reheat valves), control valves, condensate tanks, expansion tanks, flash tanks, pressure reducing valves, traps. and other steam, condensate, or chilled water equipment that is not insulated due to maintenance accessibility concerns.

B. Insulation and Jacket:

1. Non-Asbestos Glass mat, type E needled fiber.
2. Temperature maximum of 450°F, Maximum water vapor transmission of 0.00 perm, and maximum moisture absorption of 0.2 percent by volume.
3. Jacket Material: Silicon/impregnated fiberglass composite and LFP 2109 pure PTFE.
4. Core blanket shall meet ASTM C 1086-88.
5. Construction: Insulating blanket with permanent Velcro straps shall be used. The removable jacket shall reduce a 350 degree F pipe down to 93 degrees F (ambient 76 degrees F) and a 180 degree F pipe to 79 degrees F (ambient 72 degrees F), but in no case shall the insulation thickness be less than 3 inches of ET insulation. One-piece jacket body with three-ply braided pure Teflon or Kevlar thread and insulation sewn as part of jacket.

6. For large equipment, no piece shall weigh over 40 lbs. All large tanks shall come in at least two interlocking pieces. The blanket shall be custom designed for the piece of equipment being used.

2.6 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 insulation of the same thickness as adjacent insulation.

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

B. Warm or hot pipe supports: Premolded pipe insulation (180 degrees half-shells) on bottom half of pipe at supports. Material shall cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation.

2.7 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.

2.8 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.

2.9 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.

2.10 FIRESTOPPING MATERIAL

A. Other than pipe and duct insulation, refer to Section 07 84 00 FIRESTOPPING.

2.11 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 prior to application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories), and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.

C. Where removal of insulation of piping, ductwork and equipment is required to comply with Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT and Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT, such areas shall be reinsulated to comply with this specification.

D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor retarder over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

E. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

F. Construct insulation on parts of equipment such as chilled water pumps and heads of chillers, convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.

G. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.

H. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

I. Insulate PRVs, flow meters, and steam traps with removable jackets as specified in this section.

J. HVAC work not to be insulated:
   1. Internally insulated ductwork and air handling units.
   2. Relief air ducts (Economizer cycle exhaust air).
   3. Exhaust air ducts unless upstream of heat recovery equipment.

K. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

L. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

M. Firestop Pipe and Duct insulation:
   1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defined in Section 07 84 00, FIRESTOPPING.
   2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
      a. Pipe risers through floors
      b. Pipe or duct chase walls and floors
      c. Smoke partitions
      d. Fire partitions

N. Freeze protection of above grade outdoor piping (over heat tracing tape): Insulation thicknesses shall be as specified at the end of this section. Provide metal jackets for all pipes. Provide for

chilled water piping as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).

O. Provide vapor barrier jackets over insulation as follows:
   1. All interior piping and ducts exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces) that are conveying fluids below ambient air temperature.

P. Provide metal jackets over insulation as follows:
   1. All piping and ducts exposed to outdoor weather.
   2. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

Q. Provide PVC jackets over insulation as follows:
   1. Piping exposed in building, within 1829 mm (6 feet) of the floor, on piping that is not precluded in previous sections.
   2. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:
   1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
   2. Plain board:
      a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
      b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.
      c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
      d. Chilled water pumps: Insulate with removable and replaceable 1 mm thick (20 gage) aluminum or galvanized steel covers lined with insulation. Seal closure joints/flanges of covers with gasket material. Fill void space in enclosure with flexible mineral fiber insulation.
   3. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and attics:

a. 40 mm (1-1/2 inch) thick insulation faced with ASJ (white all service jacket): Supply air duct.
b. 40 mm (1-1/2 inch) thick insulation faced with ASJ: Return air duct and exhaust air duct upstream of heat recovery equipment.
c. Outside air intake ducts and 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. Cold equipment: 40 mm (1-1/2inch) thick insulation faced with ASJ.
   a. Chilled water pumps, water filter, chemical feeder pot or tank.
5. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
   a. Convertors, air separators, steam condensate pump receivers.

B. Flexible Mineral Fiber Blanket:
1. Adhere insulation to metal with 75 mm (3 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally, secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
2. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation, insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.
3. Concealed supply air ductwork.
   a. Above ceilings at a roof level, in attics, and duct work exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with FSK.
   b. Above ceilings for other than roof level: 40 mm (1 ½ inch) thick insulation faced with FSK.
4. Concealed return air duct:
   a. In attics 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.
5. Concealed outside air duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.

6. Plenums behind louvers: 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.
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.

E. 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.
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
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 0.001 perms.

F. Removable Insulation Jackets

1. To minimize heat loss from fittings, the blanket shall extend beyond mating flanges into existing insulation for a minimum of 2”. Where the blanket cannot fit over existing oversized insulation, the blanket shall butt up to existing insulation with a friction fit closing seam. All sections of pipes shall be insulated and open gaps are not acceptable. Blanket diameters that are 2” or larger than existing insulation shall be end capped to eliminate open air void.

3.3 PIPE INSULATION SCHEDULE

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 Above
122-177 degrees C (251-350 degrees F)	Mineral Fiber (Above ground piping only)	75 (3)	100 (4)	113 (4.5)	113 (4.5)

(HPS, MPS)					
100-121 degrees C (212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves, Condensate receivers and flash tanks)	Mineral Fiber (Above ground piping only)	62 (2.5)	62 (2.5)	75 (3.0)	75 (3.0)
100-121 degrees C (212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves, Condensate receivers and flash tanks)	Rigid Cellular Phenolic Foam	50 (2.0)	50 (2.0)	75 (3.0)	75 (3.0)
38-94 degrees C (100-200 degrees F) (LPR, HWS, HWR)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-99 degrees C (100-211 degrees F) (LPR, HWS, HWR)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-94 degrees C (100-200 degrees F) (LPR, HWS, HWR)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	----	----
4-16 degrees C (40-60 degrees F) (CHS, CHR)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
(40-60 degrees F) (CHS, CHR, CWS, CWR, 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)

- - - E N D - - -

SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete new stand-alone direct digital control system shall be provided under this project to serve the new equipment and renovated areas of this project. The system shall be a BACNet capable Direct Digital Control System utilizing electric actuation, including all graphics, trends, alarms, etc. All new graphics provided under this contract shall match existing graphics – obtain all required graphics files from COR. Provide 14 days notice in advance of requiring files.

B. The contractor administered by this section of the technical specifications must be in the business of installing direct digital controls for over three (3) years and must have installed and completed at least ten (10) direct digital temperature control jobs of similar design using the same model of equipment as specified. The contractor administered by this section of the technical specifications must be a Licensed Factory Representative and Installer of the manufacturer's specified for the local area, and shall have a local engineering and service office within 50 miles of the job site.

C. The basic control system shall include all sensors, controllers, instruments, valves, actuators, devices, installation and service for a complete and functional control system. All control devices (valves, dampers, actuators, etc.) are included under the controls work unless specifically specified elsewhere in the Specifications. Control system shall be designed to allow easy field adjustment of all setpoints and parameters.

D. Cooperate with the HVAC Contractor and other Subcontractors in identifying active or inactive pneumatic tubing, control wiring, equipment, etc., and assist in the actual removal. Remove all pneumatic tubing, control wiring and control devices not required to accommodate the renovated areas and new control system.

E. 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, configuration/setup hardware and software, controls and installation materials, installation labor, commissioning and startup, 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, utilizing the existing control system server and Engineering Control Center. The existing CPU/Monitor, printer, and other peripherals shall be used to form a single operator workstation. New system including interface to existing systems and equipment 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. Modify the existing ECC, if necessary, to accommodate the additional control points.

2. The contractor administered by this section of the technical specifications shall supply as required, all necessary hardware equipment and software packages to interface between any existing and new system Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices, hardware and software points provided. Network area controllers are same as remote controller units (RCU).
3. All new building controllers shall be native BACnet. All new BACnet controllers, devices and components shall be listed by BACnet Testing Laboratories. All new BACnet workstations, controllers, devices and components shall be accessible using a HTML5 Web browser interface. Browsers shall not require the use of an extension or add on software in order to access aforementioned workstations, controllers, devices, and components.
   a. If used, gateways shall be BTL listed.
   b. If used, gateways shall provide all object properties and read/write services shown on VA-approved interoperability schedules.
4. The work administered by this Section of the technical specifications shall include all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, Project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, Warranty, specified services and any other items required for a complete and fully functional Controls System.
5. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The A/E shall designate what each “mechanical systems” is composed of. The contractor administered by this Section of the technical specifications shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the ECC shall have no effect on the field controllers, including those involved with global strategies.

F. Some products are furnished but not installed by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the installation of the products. These products include but are not limited to the following:

1. Control valves.
2. Flow switches.
3. Flow meters.
4. Sensor wells and sockets in piping.
5. Terminal unit controllers.

G. Some products are installed but not furnished by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the procurement of the products. These products include but are not limited to the following:

1. Factory-furnished accessory thermostats and sensors furnished with unitary equipment.

H. Some products are not provided by, but are nevertheless integrated with the work executed by, the contractor administered by this Section of the technical specifications. These products include but are not limited to the following:

1. Fire alarm systems. If zoned fire alarm is required by the project-specific requirements, this interface shall require multiple relays, which are provided and installed by the fire alarm system contractor, to be monitored.
2. Boiler and/or chiller controls. These controls, if not native BACnet, will require a BACnet Gateway.
3. Terminal units' velocity sensors
4. Unitary HVAC equipment (rooftop air conditioning units, split systems controls. These include:
   a. Discharge temperature control.
   b. Economizer control.
   c. Flowrate control.
   d. Setpoint reset.
   e. Time of day indexing.
   f. Status alarm.
5. Steam trap monitoring system: Monitoring and alarms shall be connected to the ECC via BACnet.
6. Variable frequency drives. These controls, if not native BACnet, will require a BACnet Gateway. Additionally, all VFDs provided on this project shall be integrated into the VA's existing "Energy Essentials" software, and kW usage shall be reported.
7. The following systems have limited control (as individually noted below) from the ECC:
   a. Domestic water heating systems: low temperature, high temperature and status alarms.
   b. Elevators: status alarms.
   c. Building lighting systems: on/off and scene control.

d. Sanitary sewage/sump pumps: status alarm.

I. Suggested Responsibility Table (Prime Contractor is responsible for entire scope of work. Coordinate closely):

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, jacks and cabling	27	27	27	N/A
Automatic dampers (not furnished with equipment)	23 09 23	23	N/A	N/A
Automatic damper actuators	23 09 23	23 09 23	23 09 23	23 09 23
Manual valves	23	23	N/A	N/A
Automatic valves	23 09 23	23	23 09 23	23 09 23
Pipe insertion devices and taps, flow and pressure stations.	23	23	N/A	N/A
Thermowells	23 09 23	23	N/A	N/A
Current Switches	23 09 23	23 09 23	23 09 23	N/A
Control Relays	23 09 23	23 09 23	23 09 23	N/A
Power distribution system monitoring interfaces	23 09 23	23 09 23	23 09 23	26
Interface with chiller/boiler controls	23 09 23	23 09 23	23 09 23	26
Chiller/boiler controls interface with control system	23	23	23 09 23	26
All control system nodes, equipment, housings, enclosures and panels.	23 09 23	23 09 23	23 09 23	26
Smoke detectors	28 31 00	28 31 00	28 31 00	28 31 00
Fire/Smoke Dampers	23	23	28 31 00	28 31 00
Smoke Dampers	23	23	28 31 00	28 31 00
Fire Dampers	23	23	N/A	N/A
Chiller/starter interlock wiring	N/A	N/A	26	26
Chiller Flow Switches	23	23	23	N/A
Boiler interlock wiring	23	23	23	26
Boiler Flow Switches	23	23	23	N/A
Water treatment system	23	23	23	26
VFDs	26	26	23 09 23	26

Work/Item/System	Furnish	Install	Low Voltage Wiring	Line Power
Laboratory Environmental Controls	23 09 23	23 09 23	23 09 23	26
Fume hood controls	23 09 23	23 09 23	23 09 23	26
Medical gas panels	22	22	26	26
Laboratory Air Valves	23	23	23 09 23	N/A
Computer Room A/C Unit field-mounted controls	23	23	26	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
Fire-fighter's smoke control station (FSCS	28	28	28	28
Fan Coil Unit controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26
Unit Heater controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26
Packaged RTU space-mounted controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26
Packaged RTU unit-mounted controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26
Starters, HOA switches	23	23	N/A	26
Steam Trap Monitoring in Boiler Plant	23 21 11	23 21 11	26	26
Steam Trap Monitoring not in Boiler Plant	23 22 13	23 22 13	26	26

J. Unitary standalone systems including Unit Heaters, Cabinet Unit Heaters, Fan Coil Units, Base Board Heaters, thermal comfort ventilation fans, and similar units for control of room environment conditions may be equipped with integral controls furnished and installed by the equipment manufacturer or field mounted. Refer to equipment specifications and as indicated in project documents. Application of standalone unitary controls is limited to at least those systems wherein remote monitoring, alarm and startup are not necessary. Examples of such systems include:

1. Light-switch-operated toilet exhaust
2. Vestibule heater
3. Exterior stair heater
4. Attic heating and ventilation
5. Mechanical or electrical room heating and ventilation.

K. 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.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
B. Section 23 21 13, Hydronic Piping.
C. Section 23 22 13, Steam and Condensate Heating Piping.
D. Section 23 31 00, HVAC Ducts and Casings.
E. Section 23 64 00, Packaged Water Chillers.
F. Section 23 73 00, Indoor Central-Station Air-Handling Units.
G. Section 23 81 00, Decentralized Unitary HVAC Equipment.
H. Section 26 05 11, Requirements for Electrical Installations.
I. Section 26 05 21, Low-Voltage Electrical Power Conductors and Cables.
J. Section 26 05 26, Grounding and Bonding for Electrical Systems.
K. Section 26 05 33, Raceway and Boxes for Electrical Systems.
L. Section 26 09 23, Lighting Controls.
M. Section 26 27 26, Wiring Devices.
N. Section 26 29 11, Motor Controllers.
O. Section 27 15 00, Communications Structured Cabling
P. Section 28 31 00, Fire Detection and Alarm.

1.3 DEFINITION

A. Algorithm: A logical procedure for solving a recurrent mathematical problem; A prescribed set of well-defined rules or processes for the solution of a problem in a finite number of steps.
B. Analog: A continuously varying signal value (e.g., temperature, current, velocity etc.
C. BACnet: A Data Communication Protocol for Building Automation and Control Networks -as defined by ANSI/ASHRAE Standard 135. This communications protocol allows diverse building automation devices to communicate data and services over a network.
D. BACnet/IP: Annex J of Standard 135. It defines and allows for using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP sub-networks that share the same BACnet network number.
E. BACnet Internetwork: Two or more BACnet networks connected with routers. The two networks may use different LAN technologies.

F. BACnet Network: One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

G. BACnet Segment: One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

H. BACnet Broadcast Management Device (BBMD): A communications device which broadcasts BACnet messages to all BACnet/IP devices and other BBMDs connected to the same BACnet/IP network.

I. BACnet Interoperability Building Blocks (BIBBs): BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. These are prescribed in terms of an "A" and a "B" device. Both of these devices are nodes on a BACnet internetwork.

J. BACnet Testing Laboratories (BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

K. Baud: It is a signal change in a communication link. One signal change can represent one or more bits of information depending on type of transmission scheme. Simple peripheral communication is normally one bit per Baud. (e.g., Baud rate = 78,000 Baud/sec is 78,000 bits/sec, if one signal change = 1 bit).

L. Binary: A two-state system where a high signal level represents an "ON" condition and an "OFF" condition is represented by a low signal level.

M. BMP or bmp: Suffix, computerized image file, used after the period in a DOS-based computer file to show that the file is an image stored as a series of pixels.

N. Bus Topology: A network topology that physically interconnects workstations and network devices in parallel on a network segment.

O. Control Unit (CU): Generic term for any controlling unit, stand-alone, microprocessor based, digital controller residing on secondary LAN or Primary LAN, used for local controls or global controls

P. Deadband: A temperature range over which no heating or cooling is supplied, i.e., 22-25 degrees C (72-78 degrees F), as opposed to a single point change over or overlap).

Q. Device: a control system component that contains a BACnet Device Object and uses BACnet to communicate with other devices.

R. Device Object: Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

S. Device Profile: A specific group of services describing BACnet capabilities of a device, as defined in ASHRAE Standard 135, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator

(B-SA), and BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing which service and BIBBs are supported by the device.

T. Diagnostic Program: A software test program, which is used to detect and report system or peripheral malfunctions and failures. Generally, this system is performed at the initial startup of the system.

U. Direct Digital Control (DDC): Microprocessor based control including Analog/Digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices in order to achieve a set of predefined conditions.

V. Distributed Control System: A system in which the processing of system data is decentralized and control decisions can and are made at the subsystem level. System operational programs and information are provided to the remote subsystems and status is reported back to the Engineering Control Center. Upon the loss of communication with the Engineering Control center, the subsystems shall be capable of operating in a stand-alone mode using the last best available data.

W. Download: The electronic transfer of programs and data files from a central computer or operation workstation with secondary memory devices to remote computers in a network (distributed) system.

X. DXF: An AutoCAD 2-D graphics file format. Many CAD systems import and export the DXF format for graphics interchange.

Y. Electrical Control: A control circuit that operates on line or low voltage and uses a mechanical means, such as a temperature sensitive bimetal or bellows, to perform control functions, such as actuating a switch or positioning a potentiometer.

Z. Electronic Control: A control circuit that operates on low voltage and uses a solid-state components to amplify input signals and perform control functions, such as operating a relay or providing an output signal to position an actuator.

AA. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.

BB. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.

CC. Firmware: Firmware is software programmed into read only memory (ROM) chips. Software may not be changed without physically altering the chip.

DD. Gateway: Communication hardware connecting two or more different protocols. It translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

EE. GIF: Abbreviation of Graphic interchange format.

FF. Graphic Program (GP): Program used to produce images of air handler systems, fans, chillers, pumps, and building spaces. These images can be animated and/or color-coded to indicate operation of the equipment.

GG. Graphic Sequence of Operation: It is a graphical representation of the sequence of operation, showing all inputs and output logical blocks.

HH. I/O Unit: The section of a digital control system through which information is received and transmitted. I/O refers to analog input (AI, digital input (DI), analog output (AO) and digital output (DO). Analog signals are continuous and represent temperature, pressure, flow rate etc., whereas digital signals convert electronic signals to digital pulses (values), represent motor status, filter status, on-off equipment etc.

II. I/P: a method for conveying and routing packets of information over LAN paths. User Datagram Protocol (UDP) conveys information to “sockets” without confirmation of receipt. Transmission Control Protocol (TCP) establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

JJ. JPEG: A standardized image compression mechanism stands for Joint Photographic Experts Group, the original name of the committee that wrote the standard.

KK. Local Area Network (LAN): A communication bus that interconnects operator workstation and digital controllers for peer-to-peer communications, sharing resources and exchanging information.

LL. Network Repeater: A device that receives data packet from one network and rebroadcasts to another network. No routing information is added to the protocol.

MM. MS/TP: Master-slave/token-passing (ISO/IEC 8802, Part 3). It uses twisted-pair wiring for relatively low speed and low cost communication.

NN. Native BACnet Device: A device that uses BACnet as its primary method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

OO. Network Number: A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

PP. Object: The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

QQ. Object Identifier: An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

RR. Object Properties: Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

SS. Operating system (OS): Software, which controls the execution of computer application programs.

TT. PCX: File type for an image file. When photographs are scanned onto a personal computer they can be saved as PCX files and viewed or changed by a special application program as Photo Shop.

UU. Peripheral: Different components that make the control system function as one unit. Peripherals include monitor, printer, and I/O unit.

VV. Peer-to-Peer: A networking architecture that treats all network stations as equal partners- any device can initiate and respond to communication with other devices.

WW. PICS: Protocol Implementation Conformance Statement, describing the BACnet capabilities of a device. All BACnet devices have published PICS.

XX. PID: Proportional, integral, and derivative control, used to control modulating equipment to maintain a setpoint.

YY. Repeater: A network component that connects two or more physical segments at the physical layer.

ZZ. Router: a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

AAA. Sensors: devices measuring state points or flows, which are then transmitted back to the DDC system.

BBB. Thermostats : devices measuring temperatures, which are used in control of standalone or unitary systems and equipment not attached to the DDC system.

1.4 QUALITY ASSURANCE

A. Criteria:

1. Single Source Responsibility of subcontractor: The DDC 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, integration, and commissioning of the system. The controls subcontractor shall be in the business of design, installation and service of such building automation control systems similar in size and complexity.
2. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer’s latest standard design and have been tested and proven in actual use.
3. The controls subcontractor shall provide a list of no less than ten similar projects which have building control systems as specified in this Section. These projects must be on-line and functional such that the Department of Veterans Affairs (VA) representative could observe the control systems in full operation.

4. The controls subcontractor shall have an in-place facility within 50 miles with technical staff, spare parts inventory for the next five (5) years, and necessary test and diagnostic equipment to support the control systems.
5. The controls subcontractor shall have minimum of three years of experience in design and installation of building automation systems similar in performance to those specified in this Section. Provide evidence of experience by submitting resumes of the project manager, the local branch manager, project engineer, the application engineering staff, and the electronic technicians who would be involved with the supervision, the engineering, and the installation of the control systems. Training and experience of these personnel shall not be less than three years. Failure to disclose this information will be a ground for disqualification of the supplier.
6. Provide a competent and experienced Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Contractor employees in order to provide professional engineering, technical and management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor.

B. Codes and Standards:
1. All work shall conform to the applicable Codes and Standards.
2. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.

1.5 PERFORMANCE

A. The system shall conform to the following:
1. Graphic Display: The system shall display up to four (4) graphics on a single screen with a minimum of twenty (20) dynamic points per graphic. All current data shall be displayed within ten (10) seconds of the request.
2. Graphic Refresh: The system shall update all dynamic points with current data within eight (8) seconds. Data refresh shall be automatic, without operator intervention.
3. Object Command: The maximum time between the command of a binary object by the operator and the reaction by the device shall be two(2) seconds. Analog objects shall start to adjust within two (2) seconds.
4. Object Scan: All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or work-station will be current, within the prior six (6) seconds.
5. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed (10) seconds.

6. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every (5) seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
7. Multiple Alarm Annunciations: All workstations on the network shall receive alarms within five (5) seconds of each other.
8. Performance: Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every one (1) second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
9. Reporting Accuracy: Listed below are minimum acceptable reporting end-to-end accuracies for all values reported by the specified system:

Measured Variable	Reported Accuracy
Space temperature	±0.5 degrees C (±1 degrees F)
Ducted air temperature	±0.5 degrees C [±1 degrees F]
Outdoor air temperature	±1.0 degrees C [±2 degrees F]
Dew Point	±1.5 degrees C [±3 degrees F]
Water temperature	±0.5 degrees C [±1 degrees F]
Relative humidity	±2 percent RH
Water flow	±1 percent of reading
Air flow (terminal)	±10 percent of reading
Air flow (measuring stations)	±5 percent of reading
Carbon Monoxide (CO)	±5 percent of reading
Carbon Dioxide (CO_2)	±50 ppm
Air pressure (ducts)	±25 Pa [±0.1 inch wg]
Air pressure (space)	±0.3 Pa [±0.001 inch wg]
Water pressure	±2 percent of full scale *Note 1
Electrical Power	±0.5 percent of reading

Note 1: for both absolute and differential pressure

10. Control stability and accuracy: Control sequences shall maintain measured variable at setpoint within the following tolerances:

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 inch wg)	0–1.5 kPa (0–6 inch wg)

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±3 Pa (±0.01 inch wg)	-25 to 25 Pa (-0.1 to 0.1 inch wg)
Airflow	±10 percent of full scale	
Space Temperature	±1.0ºC (±2.0 degrees F)	
Duct Temperature	±1.5ºC (±3 degrees F)	
Humidity	±5 percent RH	MRI, SPS, PHARMACY
Fluid Pressure	±10 kPa (±1.5 psig)	0–1 MPa (1–150 psig)
Fluid Pressure	±250 Pa (±1.0 inch wg)	0–12.5 kPa (0–50 inch wg) differential

11. Extent of direct digital control: control design shall allow for at least the points indicated on the points lists on the drawings.

1.6 WARRANTY

A. Labor and materials for control systems shall be warranted for a period as specified under Warranty in FAR clause 52.246-21.

B. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no cost or reduction in service to the government. 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 connect via (through password-limited access) VPN through the internet to monitor and control the facility's building automation system. This remote connection to the facility shall be within two (2) hours of the time that the problem is reported. This coverage shall include normal business hours, after business hours, weekend and holidays. If the problem cannot be resolved with on-line support services, the Controls supplier shall dispatch the qualified personnel to the job site to resolve the problem within 24 hours after the problem is reported.

D. Controls subcontractor shall be responsible for temporary operations and maintenance of the control systems during the construction period until final commissioning, training of facility operators and acceptance of the project by VA.

1.7 SUBMITTALS

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

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including:

1. A wiring diagram for each type of input device and output device including DDC controllers, modems, repeaters, etc. Diagram shall show how the device is wired and powered, showing typical connections at the digital controllers and each power supply, as well as the device itself. Show for all field connected devices, such as, 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. 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 shall clearly reference the specification and/or drawings that it supposed to represent.
5. Sequence of operations for each system and the associated control diagrams. Equipment and control labels shall correspond to those shown on the drawings.
6. Color prints of proposed graphics with a list of points for display.
7. Furnish a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet-compliant device.
8. 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.
9. 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.
10. Riser diagrams of wiring between central control unit (CCU) and all control panels.
11. Plan drawings showing routing of LAN and locations of control panels, controllers, routers, gateways, ECC, and larger controlled devices.
12. Construction details for all installed conduit, cabling, raceway, cabinets, and similar. Construction details of all penetrations and their protection.
13. Quantities of submitted items may be reviewed but it is the responsibility of the contractor administered by this Section of the technical specifications to provide sufficient quantities for a complete and working system.

D. Product Certificates: Compliance with Article, QUALITY ASSURANCE.

E. Validation Test Plan: Along with manufacturer's literature, product certificates, wiring and functional diagrams, and sequence of operations, submit for review and approval a Validation

Test Plan which is specific to the work of this project and which references the specific controls component nomenclatures found in the control contractor's wiring and functional diagrams and the specific sequences of controls for this project and which describes how the contractor will implement the controls system validation and demonstration as specified in paragraph 3.2 SYSTEM VALIDATION AND DEMONSTRATION found in this section.

F. Licenses: Provide licenses for all software residing on and used by the Controls Systems, ECC, and portable OWS and transfer these licenses to the VA prior to completion.

G. As Built Control Drawings:
   1. Furnish three (3) copies of as-built drawings for each control system. The documents shall be submitted for approval prior to final completion.
   2. Furnish one (1) set of applicable control system prints for each mechanical system for wall mounting. The documents shall be submitted for approval prior to final completion.
   3. Furnish one (1) CD-ROM in CAD DWG and/or .DXF format for the drawings noted in subparagraphs above.

H. Operation and Maintenance (O/M) Manuals):
   1. Submit in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS.
   2. Include the following documentation:
      a. General description and specifications for all components, including logging on/off, alarm handling, producing trend reports, overriding computer control, and changing set points and other variables.
      b. Detailed illustrations of all the control systems specified for ease of maintenance and repair/replacement procedures, and complete calibration procedures.
      c. One copy of the final version of all software provided including operating systems, programming language, operator workstation software, and graphics software.
      d. Complete troubleshooting procedures and guidelines for all systems.
      e. Complete operating instructions for all systems.
      f. Recommended preventive maintenance procedures for all system components including a schedule of tasks for inspection, cleaning and calibration. Provide a list of recommended spare parts needed to minimize downtime.
      g. Training Manuals: Submit the course outline and training material to the COR for approval three (3) weeks prior to the training of VA facility personnel. These persons will be responsible for maintaining and the operation of the control systems, including programming. The COR reserves the right to modify any or all of the course outline and training material.
      h. Licenses, guaranty, and other pertaining documents for all equipment and systems.

I. Submit Performance Report to COR prior to final inspection.

1.8 INSTRUCTIONS

A. Instructions to VA operations personnel: Perform in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS, and as noted below. Contractor shall also video tape instruction sessions noted below.

1. First Phase: Formal instructions to the VA facilities personnel for a total of 16 hours, given in multiple training sessions (each no longer than four hours in length), conducted sometime between the completed installation and prior to the performance test period of the control system, at a time mutually agreeable to the Contractor and the VA.
2. Second Phase: This phase of training shall comprise of on the job training during startup, checkout period, and performance test period. VA facilities personnel will work with the Contractor's installation and test personnel on a daily basis during startup and checkout period. During the performance test period, controls subcontractor shall provide 32 hours of instructions, given in multiple training sessions (each no longer than four hours in length), to the VA facilities personnel.
3. The O/M Manuals shall contain approved submittals as outlined in Article 1.7, SUBMITTALS. The Controls subcontractor shall review the manual contents with VA facilities personnel during second phase of training.
4. Training shall be given by direct employees of THE CONTROLS system subcontractor.

1.9 PROJECT CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)

A. The peripheral devices and system support equipment shall be designed to operate in ambient condition of 20 to 35 degrees C (65 to 90 degrees F) at a relative humidity of 20 to 80 percent non-condensing.

B. The Controllers used outdoors shall be mounted in NEMA 4 waterproof enclosures, and shall be rated for operation at –40 to 65 degrees C (-40 to 150 degrees F).

C. All electronic equipment shall operate properly with power fluctuations of plus 10 percent to minus 15 percent of nominal supply voltage.

D. Sensors and controlling devices shall be designed to operate in the environment, which they are sensing or controlling.

1.10 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

135-2020 ..... BACnet A Data Communication Protocol for Building Automation and Control Networks

147-2019 ..... Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems

C. Federal Communication Commission (FCC):

D. Rules and Regulations Title 47 Chapter 1-2014 Part 15: Radio Frequency Devices

E. Institute of Electrical and Electronic Engineers (IEEE):

F. 802.3-2018 Standard for Ethernet

G. National Fire Protection Association (NFPA):

H. 70-2020 National Electric Code

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Spare parts shall be available for at least five years after completion of this contract.

2.2 CONTROLS SYSTEM ARCHITECTURE

A. The Direct Digital Control (DDC) system shall be based on the Niagara Framework (or “Niagara”), a Java-based framework developed by Tridium. Systems not developed on the Niagara Framework platform are unacceptable.

All Niagara software shall have an open license; i.e., shall have the following Niagara Compatibility Statement (NICS): "accept.station.in=*"; "accept.station.out=*" and "accept.wb.in:=" and "accept.wb.out=* ".

1. The contractor administered by this section of the technical specifications shall install a new, independent CAT6 communication network between Building Controllers (BC) and Programmable Equipment Controllers (PEC) communicating utilizing FOX TCP/IP communications protocol, in the same contiguous building structure.
2. Application Specific Controllers (ASC) shall communicate via LonMark/LonTalk and/or BACnet MS/TP communication protocols to Building Controllers (BC) or Programmable Equipment Controllers (PEC).

B. General

1. The Controls Systems shall consist of multiple Nodes and associated equipment connected by industry standard digital and communication network arrangements.
2. The 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.

C. 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.

D. 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. They may also utilize digital wireless technologies as appropriate to the application and if required by the VA.
3. All necessary telephone lines, ISDN lines and internet Service Provider services and connections will be provided by the VA.

E. Third Party Interfaces:
1. The contractor administered by this Section of the technical specifications shall include necessary hardware, equipment, software and programming to allow data communications between the controls systems and building systems supplied by other trades.
2. Other manufacturers and contractors supplying other associated systems and equipment shall provide their necessary hardware, software and startup at their cost and shall cooperate fully with the contractor administered by this Section of the technical specifications in a timely manner and at their cost to ensure complete functional integration.

F. 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.
5. 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, BACnet.
   1. The Data link / physical layer protocol between the ECC and all B-BC's (for communication) acceptable to the VA throughout its facilities is Ethernet (ISO 8802-3) and BACnet/IP.
B. Each controller shall have a communication port for connection to an operator interface.
C. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
   1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, reports, system software, and custom programs shall be viewable and editable from each internet controller.
   2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute specified control system operation. An authorized operator shall be able to edit cross-controller links by typing a standard object address.
D. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring. Expansion shall not require operator interface hardware additions or software revisions.
E. ECCs and Controllers with real-time clocks shall use the BACnet Time Synchronization service. The system shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight savings and standard time as applicable.

2.4 ENGINEERING CONTROL CENTER (ECC)

A. The existing ECC and operator's workstation shall be used. ECC memory shall be upgraded to add an amount sufficient to provide 5 years of continuous trend data for all equipment provided under this contract.

B. The ECC resides on a high-speed network with controllers. The ECC and each standard browser connected to server shall be able to access all system information.

C. ECC and controllers shall communicate using BACnet protocol. ECC and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ASHRAE/ANSI 135, BACnet Annex J.

2.5 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.

2.6 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.

2.7 NETWORK AND DEVICE NAMING CONVENTION

A. Network Numbers

1. BACnet network numbers shall be based on a "facility code, network" concept. The "facility code" is the VAMC's or VA campus' assigned numeric value assigned to a specific facility or building. The "network" typically corresponds to a "floor" or other logical configuration within the building. BACnet allows 65535 network numbers per BACnet internet work.

2. The network numbers are thus formed as follows: "Net #" = "FFFNN" where:

a. FFF = Facility code (see below)

b. NN = 00-99 This allows up to 100 networks per facility or building

B. Device Instances

1. BACnet allows 4194305 unique device instances per BACnet internet work. Using Agency's unique device instances are formed as follows: "Dev #" = "FFFNNDD" where

   a. FFF and N are as above and

   b. DD = 00-99, this allows up to 100 devices per network.

2. Note Special cases, where the network architecture of limiting device numbering to DD causes excessive subnet works. The device number can be expanded to DDD and the network number N can become a single digit. In NO case shall the network number N and the device number D exceed 4 digits.

3. Facility code assignments:

4. 000-400 Building/facility number

5. Note that some facilities have a facility code with an alphabetic suffix to denote wings, related structures, etc. The suffix will be ignored. Network numbers for facility codes greater than 400 will be assigned in the range 000-399.

C. Device Names

1. Name the control devices based on facility name, location within a facility, the system or systems that the device monitors and/or controls, or the area served. The intent of the device naming is to be easily recognized. Names can be up to 254 characters in length, without embedded spaces. Provide the shortest descriptive, but unambiguous, name. For example, in building #123 prefix the number with a “B” followed by the building number, if there is only one chilled water pump "CHWP-1", a valid name would be "B123.CHWP. 1.STARTSTOP". If there are two pumps designated "CHWP-1", one in a basement mechanical room (Room 0001) and one in a penthouse mechanical room (Room PH01), the names could be "B123.R0001.CHWP.1. STARTSTOP" or "B123.RPH01.CHWP.1.STARTSTOP". In the case of unitary controllers, for example a VAV box controller, a name might be "B123.R101.VAV". These names should be used for the value of the "Object_Name" property of the BACnet Device objects of the controllers involved so that the BACnet name and the EMCS name are the same.

2.8 BACnet DEVICES

A. All BACnet Devices – controllers, gateways, routers, actuators, Operator Displays, and sensors shall conform to BACnet Device Profiles and shall be BACnet Testing Laboratories (BTL) -Listed as conforming to those Device Profiles. Protocol Implementation Conformance Statements (PICSs), describing the BACnet capabilities of the Devices shall be published and available for the Devices through links in the BTL website.

1. BACnet Building Controllers, shall conform to the BACnet B-BC Device Profile, and shall be BTL-Listed as conforming to the B-BC Device Profile. The Device's PICS shall be submitted.
2. BACnet Advanced Application Controllers shall conform to the BACnet B-AAC Device Profile and shall be BTL-Listed as conforming to the B-AAC Device Profile. The Device's PICS shall be submitted.
3. BACnet Application Specific Controllers shall conform to the BACnet B-ASC Device Profile and shall be BTL-Listed as conforming to the B-ASC Device Profile. The Device's PICS shall be submitted.
4. BACnet Smart Actuators shall conform to the BACnet B-SA Device Profile and shall be BTL-Listed as conforming to the B-SA Device Profile. The Device's PICS shall be submitted.
5. BACnet Smart Sensors shall conform to the BACnet B-SS Device Profile and shall be BTL-Listed as conforming to the B-SS Device Profile. The Device's PICS shall be submitted.
6. BACnet routers and gateways shall conform to the BACnet B-OTH Device Profile, and shall be BTL-Listed as conforming to the B-OTH Device Profile. The Device's PICS shall be submitted.

2.9 CONTROLLERS

A. General. Provide an adequate number of BTL listed B-BC building controllers, BTL listed B-AAC, BTL listed B-ASC, BTL listed B-SA, and BTL listed B-SS's to achieve the performance specified in the Part 1 Article on "System Performance." Each of these controllers shall meet the following requirements.

1. Communication.
   a. Each B-BC controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications.
   b. Each B-BC controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to a portable operator's terminal. If this port is not available built into the controller, contractor is to install a 4 port unmanaged switch inside the B-BC control cabinet.
2. Keypad. A local keypad and display shall be provided for each controller. The keypad shall be provided for interrogating and editing data. Provide a system security password to prevent unauthorized use of the keypad and display.
3. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
4. Memory. The controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
5. Battery. The controller shall include a battery for continued operation during a short term power outage.

6. The controller shall be able to operate at 90 percent to 110 percent of nominal voltage rating and shall perform an orderly shutdown less than 80 percent nominal voltage. Controller operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 watt at 1 meter (3 feet).
7. Transformer. Power supply for the ASC must be rated at a minimum of 125 percent of B-ASC power consumption and shall be of the fused or current limiting type.

B. Provide BTL-Listed B-ASC application specific controllers for each piece of equipment for which they are constructed. Application specific controllers shall communicate with other BACnet devices on the internetwork using the BACnet Read (Execute) Property service.

1. Each B-ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
2. Each B-ASC will contain sufficient I/O capacity to control the target system.
3. Communication.
   a. Each controller shall 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 percent to 110 percent of nominal voltage rating and shall perform an orderly shutdown below 80 percent. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 watts at 1 meter (3 feet).

C. Direct Digital Controller Software

1. The software programs specified in this section shall be commercially available, concurrent, multi-tasking operating system and support the use of software application that operates under DOS, Linux,or Microsoft Windows.
2. All points shall be identified by up to 30-character point name and 16-character point descriptor. The same names shall be used at the ECC.
3. All control functions shall execute within the stand-alone control units. All new controllers installed will also include all software and/or hardware required to program, commission, or

alter the sequence of operation of said controller(s). Controllers requiring software or hardware that is not commercially available will not be allowed. Installation of software and/or hardware for controller configuration will be the responsibility of the DDC contractor. COR will direct to install said hardware and/or software on either the B-AWS or portable operator terminal. The VA shall be able to customize control strategies and sequences of operations defining the appropriate control loop algorithms and choosing the optimum loop parameters without requiring the services of a DDC contractor.

4. All controllers shall be capable of being programmed to utilize stored default values for assured fail-safe operation of critical processes. Default values shall be invoked upon sensor failure or, if the primary value is normally provided by the central or another CU, or by loss of bus communication. Individual application software packages shall be structured to assume a fail-safe condition upon loss of input sensors. Loss of an input sensor shall result in output of a sensor-failed message at the ECC. Each ACU and RCU shall have capability for local readouts of all functions. The UCUs shall be read remotely.
5. All DDC control loops shall be able to utilize any of the following control modes:
   a. Two position (on-off, slow-fast) control.
   b. Proportional control.
   c. Proportional plus integral (PI) control.
   d. Proportional plus integral plus derivative (PID) control. All PID programs shall automatically invoke integral wind up prevention routines whenever the controlled unit is off, under manual control of an automation system or time-initiated program.
   e. Automatic tuning of control loops.
6. System Security: Operator access shall be secured using individual password and operator's name. Passwords shall restrict the operator to the level of object, applications, and system functions assigned to him. A minimum of three (3)or a maximum of six (6) levels of security for operator access shall be provided.
7. Application Software: The controllers shall provide the following programs as a minimum for the purpose of optimizing energy consumption while maintaining comfortable environment for occupants. All application software shall reside and run in the system digital controllers. Editing of the application shall occur at the ECC or via a portable operator's terminal, when it is necessary, to access directly the programmable unit.
   a. Economizer: An economizer program shall be provided for Central Air Handling systems. This program shall control the position of air handler relief, return, and outdoor dampers. If the outdoor air dry bulb temperature and humidity fall below changeover set point the energy control center will modulate the dampers to provide 100 percent outdoor air. The operator shall be able to override the economizer cycle and return to minimum outdoor air operation at any time.

b. Night Setback/Morning Warm up Control: The system shall provide the ability to automatically adjust set points for this mode of operation.

c. Optimum Start/Stop (OSS): Optimum start/stop program shall automatically be coordinated with event scheduling. The OSS program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by the time of occupancy, and it shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period and still maintain desired comfort conditions. The OSS program shall consider both outside weather conditions and inside zone conditions. The program shall automatically assign longer lead times for weekend and holiday shutdowns. The program shall poll all zones served by the associated AHU and shall select the warmest and coolest zones. These shall be used in the start time calculation. It shall be possible to assign occupancy start times on a per air handler unit basis. The program shall meet the local code requirements for minimum outdoor air while the building is occupied. Modification of assigned occupancy start/stop times shall be possible via the ECC.

d. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or a group of points according to a stored time. This program shall provide the capability to individually command a point or group of points. When points are assigned to one common load group it shall be possible to assign variable time advances/delays between each successive start or stop within that group. Scheduling shall be calendar based and advance schedules may be defined up to one year in advance. Advance schedule shall override the day-to-day schedule. The operator shall be able to define the following information:

   1) Time, day.
   2) Commands such as on, off, auto.
   3) Time delays between successive commands.
   4) Manual overriding of each schedule.
   5) Allow operator intervention.

e. Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the ECC based on time and events. An alarm shall be able to start programs, login the event, print and display the messages. The system shall allow the operator to prioritize the alarms to minimize nuisance reporting and to speed operator’s response to critical alarms. A minimum of six (6) priority levels of alarms shall be provided for each point.

f. Remote Communications: The system shall have the ability to dial out in the event of an alarm to the ECC and alpha-numeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself.

The operator shall be able to remotely access and operate the system using dial up communications. Remote access shall allow the operator to function the same as local access.

g. Maintenance Management (PM): The program shall monitor equipment status and generate maintenance messages based upon the operators defined equipment run time, starts, and/or calendar date limits. A preventative maintenance alarm shall be printed indicating maintenance requirements based on pre-defined run time. Each preventive message shall include point description, limit criteria and preventative maintenance instruction assigned to that limit. A minimum of 480-character PM shall be provided for each component of units such as air handling units.

2.10 SENSORS (AIR, WATER AND STEAM)

A. Sensors' measurements shall be read back to the DDC system, and shall be visible by the ECC.

B. Temperature and Humidity Sensors shall be electronic, vibration and corrosion resistant for wall, immersion, and/or duct mounting. Provide all remote sensors as required for the systems.

1. Temperature Sensors: thermistor type for terminal units and Resistance Temperature Device (RTD) with an integral 4-20 mA or 0-10 VDC transmitter type for all other sensors.

a. Duct sensors shall be rigid or averaging type as shown on drawings. Averaging sensor shall be a minimum of 1 linear foot of sensing element for each square feet of cooling/heating coil face area.

b. Immersion sensors shall be provided with a separable well made of stainless steel, bronze or monel material. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. Temperature well shall be filled with a thermal compound compatible with installed sensor.

c. All space sensors shall be equipped with in-space User set-point adjustment, override switch, numerical temperature display on sensor cover, and BACnet communication port. Match room thermostats. Provide a tooled-access cover.

1) Public space sensor: setpoint adjustment shall be only through the ECC or through the DDC system's diagnostic device/laptop. Do not provide in-space User set-point adjustment. Provide an opaque keyed-entry cover if needed to restrict in-space User set-point adjustment.

d. Outdoor air temperature sensors shall have watertight inlet fittings and be shielded from direct sunlight.

e. Room security sensors shall have stainless steel cover plate with insulated back and security screws.

f. Wire: Twisted, shielded-pair cable.

g. Output Signal: 4-20 mA or 0-10 VDC.

2. Humidity Sensors: Bulk polymer sensing element type.

a. Duct and room sensors shall have a sensing range of 20 to 80 percent with accuracy of ± 2 percent RH (NIST traceable), including hysteresis, linearity, and repeatability.
b. Outdoor humidity sensors shall be furnished with element guard and mounting plate and have a sensing range of 0 to 100 percent RH.
c. Humidity sensors in Operating Rooms, Cath Labs and Clean Supply rooms shall be equipped with numerical displays.
d. Continuous Output Signal: 4-20 mA or 0-10 VDC.

C. Static Pressure Sensors: Non-directional, temperature compensated.
1. 4-20 mA or 0-10 VDC output signal.
2. 0 to 5 inches wg for duct static pressure range.
3. 0 to 0.25 inch wg for Building static pressure range.

D. 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.

2.11 STEAM AND WATER METER DEVICES

A. Steam and water meter applications:
1. HVAC Hydronic System Water Meters:
a. Chilled Water, Heating Hot Water systems: Provide electromagnetic flowmeters with temperature sensors to determine energy flow.
2. Steam Meters: Provide insertion turbine type flowmeters, along with temperature sensors and pressure transducers to develop the energy flow.

B. HVAC Hydronic System Water - Electromagnetic Flow Meters:
1. Electromagnetic Flow Meter complete with integral or remote electronics module as scheduled.
a. The flow tube shall be epoxy-coated steel with 316 stainless steel sensing electrodes, polypropylene or ebonite liner for low temperature service, and PFTE liner for hot water service.
b. Connections to the piping shall be ANSI Class 150 flanges. The contractor is responsible for providing suitable mating flanges.
c. For installations in non-metallic pipe, install grounding rings between flanges.
d. Meter shall be suitable for 25% warmer than the fluid operating temperature and for 25% higher than either the fluid’s operating pressure or 25% higher than the piping system’s safety valve set pressure, whichever is higher.
e. Meter shall be suitable for installation in ambient conditions ranging from -29 to 60 degrees C (-20 to 140 degrees F).
f. The flow meter shall be sized by the manufacturer for each specific application and installed according to manufacturer’s recommendations.

2. A measurement system built and calibrated by a single manufacture, consisting of a flow meter, two temperature sensors, a BTU meter, temperature thermowells, and all required mechanical installation hardware. A certificate of NIST* traceable calibration shall be provided with each system. All equipment shall be covered by a manufacturer's two year warranty.
3. A BTU meter shall provide the following points both at the integral LCD and as outputs to the building control system: Energy Total, Energy Rate, Flow Rate, Supply Temperature, and Return Temperature. Output signals shall be BACnet MS/TP, BACnet/IP, or via individual analog and pulse outputs. Each BTU meter shall be factory programmed for its specific applicication, and shall be re-programmable using the front panel keypad (no special interface device or computer required.
4. Temperature sensors shall be loop-powered current based (mA) sensors and shall be bath-calibrated and matched (NIST* traceable) for the specific temperature range for each application. The calibrated differential temperature used in the energy calculation shall be accurate to within +0.15 Deg. F (including the error from individual temperature sensors, sensor matching, input offsets, and calculations).
5. Refer to meter schedule for specific flow meter type. The flow meter shall be installed in either the supply or return pipe of the system to be measured (refer to drawings for locations), following the manufacturer's instructions with particular attention to upstream and downstream straight pipe runs.
6. Provide Meter Data Head.
   a. Meters shall have digital readout of flow rate and totalization located at transmitter and transmit flow rate and totalization digital signals to the BTL-Listed B-BC building controllers specified in this section.
   b. The electronics module shall include a backlit graphic display and keypad.
   c. Output signals shall be a 4-20mA and programmable pulse.
   d. Each flow meter shall be factory programmed for its specific application and shall be re-programmable using the integral keypad on the converter (no special interface device or computer required).
   e. Provide programmable microprocessor electronics with on-board programming. Output signals shall be immune to ambient temperature swings. Processor shall include continuous self-diagnostic routines that identify electronics problems and provide a warning. Electronics shall be replaceable in the field without affecting metering accuracy. Provide power supply as recommended by meter manufacturer. Mount electronics in a NEMA 4 aluminum enclosure.
      1) Power supply to meter and transmitter shall be 24VDC. Provide a Class 2 control voltage transformer for 24VDC power to meter as needed.

2) Provide the ability to maintain 24-month retention of RAM contents when all other power sources are removed.

7. Calibration:
   a. A certificate of calibration shall be provided with each flow meter.
8. Performance:
   a. The flow meter shall be programmed by the manufacture for each specific application and shall be ready to use upon delivery.
   b. Each flow meter shall be individually wet-calibrated and accurate within plus or minus 0.4 percent of reading from 3.3 to 30 feet per second velocity.
   c. Minimum turndown ratio shall be 20:1.
   d. The meter shall provide a loop-powered 4-20 mA output signal calibrated in direct mass flow rate units for connection to the Central Direct-Digital Control System.
   e. In addition, an integral pulse output for water mass flow totalization shall be provided. All outputs shall be linear with mass flow rate.

C. HVAC Steam System Insertion Turbine Flow Meters:
   1. Insertion Turbine Flow Meter complete with integral or remote electronics module as scheduled.
      a. Turndown shall 100:1.

2.12 CONTROL CABLES

A. General:
   1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Comply with Sections 27 05 26 and 26 05 26.
   2. Cable conductors to provide protection against induction in circuits. Crosstalk attenuation within the System shall be in excess of -80 dB throughout the frequency ranges specified.
   3. Minimize the radiation of RF noise generated by the System equipment so as not to interfere with any audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System may service.
   4. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs.
   5. Label system’s cables on each end. Test and certify cables in writing to the VA before conducting proof-of-performance testing. Minimum cable test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges used. Make available all cable installation and test records at demonstration to the VA. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.

6. Power wiring shall not be run in conduit with communications trunk wiring or signal or control wiring operating at 100 volts or less.

B. Analogue control cabling shall be not less than No. 18 AWG solid or stranded, with thermoplastic insulated conductors as specified in Section 26 05 21.

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. All MS/TP communications cables for devices utilizing the EIA-485 standard must be listed for use on EIA-485 networks by the manufacturer of the cable. This requirement overrides any cable recommendation by the controller manufacturer. The use of EIA-485 communication cables shall not affect the warranty from the installing DDC contractor. Cables shall have the following characteristic:

1. Nominal Impedance: 100-130 Ohms
2. Twisted/shielded construction of 1, 1.5, or 2 pairs depending on controller requirements.
3. Be plenum rated when required
4. Cables designated for use by the cable manufacturer for use in PA or Speaker systems shall not be allowed, regardless of recommendations by the controller manufacturer.

E. Optical digital communication fiber, if used, shall be Multimode or Single mode fiber, 62.5/125 micron for multimode or 10/125 micron for single mode micron with SC or ST connectors as specified in TIA-568-C.1. Terminations, patch panels, and other hardware shall be compatible with the specified fiber and shall be as specified in Section 27 15 00. Fiber-optic cable shall be suitable for use with the 100Base-FX or the 100Base-SX standard (as applicable) as defined in IEEE Std 802.3.

2.13 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 recommended finish, setpoint range and temperature display and external adjustment:

1. Electronic Thermostats: Solid-state, microprocessor based, BACnet enabled programmable to daily, weekend, and holiday schedules.
   a. Public Space Thermostat: Public space thermostat shall have a thermistor sensor and shall not have a visible means of set point adjustment. Adjustment shall be via the digital controller to which it is connected.

b. Patient Room Thermostats: thermistor with in-space User set point adjustment and an on-casing room temperature numerical temperature display.

c. Battery replacement without program loss.

B. Strap-on aquastat shall be enclosed in a dirt-and-moisture proof housing with adjustable temperature switching point and minimum single pole, double throw switch. Variable setpoint and variable differential ranges selected for the application. Automatic reset.

C. Freezestats shall have a minimum of 300 mm (one linear foot) of sensing element for each 0.093 square meter (one square foot) of coil area. A freezing condition at any increment of 300 mm (one foot) anywhere along the sensing element shall be sufficient to operate the thermostatic element. Freezestats shall be manually-reset.

D. Room Humidistats: Provide fully proportioning humidistat with adjustable throttling range for accuracy of settings and conservation. The humidistat shall have set point scales shown in percent of relative humidity located on the instrument. Systems showing moist/dry or high/low are prohibited.

E. Low Signal Selector High Limit Duct Humidistat: Duct mounted high limit humidistat mounted downstream of the humidifier steam injection grid to protect the ductwork and other components from moisture in the event of humidifier loop problems. Typically set at 70 percent to 80 percent RH the device provides proportional signal back to steam control equipment as duct humidity approaches high limit setpoint thus providing more accurate control. Duct mounted device with polymer sensor:

1. Output 4 to 20 milliamp or 0-10 VDC.
2. Setpoint range 60 percent RH to 95 percent RH.
3. Proportional Band range 5 percent to 30 percent.
4. Auxiliary contacts for alarms.
5. Accuracy 2 percent RH and drift less than 0.5 percent per year.

2.14 FINAL CONTROL ELEMENTS AND OPERATORS

A. Fail Safe Operation: Control valves and dampers shall provide "fail safe" operation in either the normally open or normally closed position as required for freeze, moisture, and smoke or fire protection.

B. Spring Ranges: Range as required for system sequencing and to provide tight shut-off.

C. Power Operated Control Dampers (other than VAV Boxes): Factory fabricated, balanced type dampers. All modulating dampers shall be opposed blade type and gasketed. Blades for two-position, duct-mounted dampers shall be parallel, airfoil (streamlined) type for minimum noise generation and pressure drop.

1. Leakage: Outside air and relief air dampers shall be insulated and thermally broken with an air leakage rating not to exceed 8 cfm/sq. ft. at 4” differential static pressure. Return air and

other control dampers leakage rate shall not exceed 10.5 cfm/sq. ft. at 4" differential static pressure.

2. Frame shall be galvanized steel channel with seals as required to meet leakage criteria.
3. Blades shall be galvanized steel or aluminum, 200 mm (8 inch) maximum width, with edges sealed as required.
4. Bearing shall be nylon, bronze sleeve or ball type.
5. Hardware shall be zinc-plated steel. Connected rods and linkage shall be non-slip. Working parts of joints shall be brass, bronze, nylon or stainless steel.
6. Maximum air velocity and pressure drop through free area of the dampers:
   a. Smoke damper in air handling unit: 305 meter per minute (1000 fpm).
   b. Duct mounted damper: 600 meter per minute (2000 fpm).
   c. Maximum static pressure loss: 50 Pascal (0.20 inches water gauge).

D. Smoke Dampers and Combination Fire/Smoke Dampers: Dampers and operators are specified in Section 23 31 00, HVAC DUCTS AND CASINGS. Control of these dampers is specified under this Section.

E. Control Valves:
1. Valves shall be rated for a minimum of 150 percent of system operating pressure at the valve location but not less than 900 kPa (125 psig).
2. Valves 50 mm (2 inches) and smaller, 0 percent leakage rate for port connected to coil, specifically designed for modulating hydronic service and ISO 9001 compliant:
   a. Body
      1) ANSI B16.5 Class 150
      2) Cast Bronze or brass
      3) Threaded (FNPT) or soldered connections
   b. Bonnet
      1) Brass
      2) Packing: Reinforced Teflon or Carbon Filled Teflon and EPDM O-Ring
   c. Trim
      1) Stem: Stainless Steel
      2) Ball: Stainless Steel, equal percentage flow caharacteristic or modified equal percentage flow characteristic for 2-way, linear for 3-way
      3) Seat: Reinforced Teflon or Carbon Filled Teflon
3. Valves 60 mm (2 1/2 inches) and greater shall be bronze or iron body with flanged connections.
   a. Brass or bronze seats except for valves controlling media greater than 100 degrees C (210 degrees F), which shall have stainless steel seats.
   b. Flow characteristics:

1) Three way modulating valves shall be globe pattern. Position versus flow relation shall be linear relation for steam or equal percentage for water flow control.
2) Two-way modulating valves shall be globe pattern. Position versus flow relation shall be linear for steam and equal percentage for water flow control.
3) Two-way 2-position valves shall be ball, gate or butterfly type.

c. Maximum pressure drop:
1) Two position steam control: 20 percent of inlet gauge pressure.
2) Modulating Steam Control: 80 percent of inlet gauge pressure (acoustic velocity limitation).
3) Modulating water flow control, greater of 3 meters (10 feet) of water or the pressure drop through the apparatus.

4. Two position water valves shall be line size.

F. Damper and Valve Operators and Relays:
1. Electric operator shall provide full modulating control of dampers and valves. For dampers a linkage and pushrod shall be furnished for mounting the actuator on the damper frame internally in the duct, externally in the duct, externally on the duct wall, or shall be furnished with a direct-coupled design. Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment. The motor(s) shall have sufficient closure torque to allow for complete closure of valve or damper under pressure. Provide multiple motors as required to achieve sufficient close-off torque.
a. Minimum valve close-off pressure shall be equal to the system pump's dead-head pressure, minimum 50 psig for valves smaller than 4 inches.
2. Electronic damper operators: Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment. The motors shall have sufficient closure torque to allow for complete closure of valve or damper under pressure. Provide multiple motors as required to achieve sufficient close-off torque.
a. VAV Box actuator shall be mounted on the damper axle or shall be of the air valve design, and shall provide complete modulating control of the damper. The motor shall have a closure torque of 35-inch pounds minimum with full torque applied at close off to attain minimum leakage.
3. See and coordinate drawings for required control operation.

2.15 AIR FLOW CONTROL

A. Airflow and static pressure shall be controlled via digital controllers with inputs from airflow control measuring stations and static pressure inputs as specified. Controller outputs shall be analog or pulse width modulating output signals. The controllers shall include the capability to control via

simple proportional (P) control, proportional plus integral (PI), proportional plus integral plus derivative (PID), and on-off. The airflow control programs shall be factory-tested programs that are documented in the literature of the control manufacturer.

B. Air Flow Measuring Station -- Electronic Thermal Type:

1. Air Flow Sensor Probe:

   a. Each air flow sensor shall contain two individual thermal sensing elements. One element shall determine the velocity of the air stream while the other element shall compensate for changes in temperature. Each thermal flow sensor and its associated control circuit and signal conditioning circuit shall be factory calibrated and be interchangeable to allow replacement of a sensor without recalibration of the entire flow station. The sensor in the array shall be located at the center of equal area segment of the duct or fan inlet and the number of sensors shall be adequate to accommodate the expected velocity profile and variation in flow and temperature. The airflow station shall be of the insertion type in which sensor support structures are inserted from the outside of the ducts to make up the complete electronic velocity array.

   b. Thermal flow sensor shall be constructed of hermetically sealed thermistors or nickel chromium or reference grade platinum wire, wound over an epoxy, stainless steel or ceramic mandrel and coated with a material suitable for the conditions to be encountered. Each dual sensor shall be mounted in an extruded aluminum alloy strut.

2. Air Flow Sensor Grid Array:

   a. Each sensor grid shall consist of a lattice network of temperature sensors and linear integral controllers (ICs) situated inside an aluminum casing suitable for mounting in a duct or fan inlet. Each sensor shall be mounted within a strut facing downstream of the airflow and located so that it is protected on the upstream side. All wiring shall be encased (out of the air stream) to protect against mechanical damage.

   b. The casing shall be made of welded aluminum of sufficient strength to prevent structural bending and bowing. Steel or iron composite shall not be acceptable in the casing material.

   a. Pressure drop through the flow station shall not exceed 4 Pascal (0.015 inch WG) at 1,000 meter per minute (3,000 FPM).

3. Fan Inlet Air Flow Measuring Stations:

   a. Fan inlet airflow measuring stations for installation at supply and return fan inlets shall include flow transducers with minimum .50% full-scale accuracy signal processors. The minimum accuracy shall be 2% of reading or better thru a velocity range of 500-8000 fpm.

3. Electronics Panel:

a. Electronics Panel shall consist of a surface mounted enclosure complete with solid-state microprocessor and software.

b. Electronics Panel shall be A/C powered 24 VAC and shall have the capability to transmit signals of 4-20 ma or 0-10 VDC type or PWM type for use in control of the HVAC Systems. The electronic panel shall have the capability to accept user defined scaling parameters for all output signals.

c. Electronics Panel shall have the capability to digitally display airflow in CFM and LPS and temperature in degrees F and degrees C. The displays shall be provided as an integral part of the electronics panel. The electronic panel shall have the capability to totalize the output flow in CFM for two or more systems, as required. A single output signal shall be provided which will equal the sum of the systems totalized. Output signals shall be provided for temperature and airflow. Provide remote mounted air flow or temperature displays where indicated on the plans.

d. Electronics Panel shall have the following:

1) Minimum of 12-bit A/D conversion.

2) Field adjustable digital primary output offset and gain.

3) Airflow analog output scaling of 100 to 10,000 FPM.

4) Temperature analog output scaling from -45 degrees C to 70 degrees C (-50 degrees F to 160 degrees F).

5) Analog output resolution (full scale output) of 0.025 percent.

e. All readings shall be in I.P. and S.I. units.

4. Thermal flow sensors and its electronics shall be installed as per manufacturer's instructions. The required probe sensor density shall be as follows:

Probe Sensor Density

Area (square feet)	Qty. Sensors
<=1	2
>1 to <4	4
4 to <8	6
8 to <12	8
12 to <16	12
>=16	16

C. Complete installation shall not exhibit more than ± 2.0 percent error in airflow measurement output for variations in the angle of flow of up to 10 percent in any direction from its calibrated orientation. Repeatability of readings shall be within ± 0.25 percent.

D. Static Pressure Measuring Station: shall consist of one or more static pressure sensors and transmitters along with relays or auxiliary devices as required for a complete functional system.

The span of the transmitter shall not exceed two times the design static pressure at the point of measurement. The output of the transmitter shall be true representation of the input pressure with plus or minus 25 Pascal (0.1 inch) W.G. of the required input pressure:

1. Static pressure sensors shall have the same requirements as Airflow Measuring Devices except that total pressure sensors are optional, and only multiple static pressure sensors positioned on an equal area basis connected to a network of headers are required.
2. For systems with multiple major or main trunk supply ducts, furnish a static pressure transmitter for each trunk duct. The transmitter signal representing the lowest static pressure shall be selected and this shall be the input signal to the controller.
3. The controller shall receive the static pressure transmitter signal and Control Unit (CU) shall provide a control output signal to the supply fan capacity control device. The control mode shall be proportional plus integral (PI) (automatic reset) and where required shall also include derivative mode.
4. In systems with multiple static pressure transmitters, provide a switch located near the fan discharge to prevent excessive pressure during abnormal operating conditions. High-limit switches shall be manually reset.

E. Airflow Synchronization:

1. Systems shall consist of an air flow measuring station for each main supply and return duct, the CU and such relays, as required to provide a complete functional system that will maintain a constant flow rate difference between supply and return air to an accuracy of ±10 percent. In systems where there is no suitable location for a flow measuring station that will sense total supply or return flow, provide multiple flow stations with a differential pressure transmitter for each station. Signals from the multiple transmitters shall be added through the CU such that the resultant signal is a true representation of total flow.
2. The total flow signals from supply and return air shall be the input signals to the CU. This CU shall track the return air fan capacity in proportion to the supply air flow under all conditions.

2.16 SAFETY

A. Provide hard-wired interlocked connections for such all safety devices, such as freeze stats, smoke detectors, smoke dampers, and refrigerant leak detection devices. All safety devises shall be provided with additional dry contacts and shall be connected to the DDC system for monitoring and sequencing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Examine project plans for control devices and equipment locations; and report any discrepancies, conflicts, or omissions to COR for resolution before proceeding with installation.

2. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
3. Install all equipment and piping in readily accessible locations. Do not run tubing and conduit concealed under insulation or inside ducts.
4. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
5. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
6. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
7. Install equipment level and plumb.

B. Electrical Wiring Installation:

1. All wiring and cabling shall be installed in conduits. Install conduits and wiring in accordance with Specification Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Conduits carrying control wiring and cabling shall be dedicated to the control wiring and cabling: these conduits shall not carry power wiring. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.
2. Install analog signal and communication cables in conduit and in accordance with Specification Division 27 – COMMINICATIONS. Install digital communication cables in conduit and in accordance with Specification Section 27 15 00, COMMINICATIONS STRUCTURED CABLING.
3. Install conduit and wiring between operator workstation(s), digital controllers, electrical panels, indicating devices, instrumentation, miscellaneous alarm points, thermostats, and relays as shown on the drawings or as required under this section.
4. Install all electrical work required for a fully functional system and not shown on electrical plans or required by electrical specifications. Where low voltage (less than 50 volt) power is required, provide suitable Class B transformers.
5. Install all system components in accordance with local Building Code and National Electric Code.
   a. Splices: Splices in shielded and coaxial cables shall consist of terminations and the use of shielded cable couplers. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties.
   b. Equipment: Fit all equipment contained in cabinets or panels with service loops, each loop being at least 300 mm (12 inches) long. Equipment for fiber optics system shall be rack mounted, as applicable, in ventilated, self-supporting, code gauge steel enclosure. Cables shall be supported for minimum sag.

c. Cable Runs: Keep cable runs as short as possible. Allow extra length for connecting to the terminal board. Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter.

d. Use vinyl tape, sleeves, or grommets to protect cables from vibration at points where they pass around sharp corners, through walls, panel cabinets, etc.

6. Conceal cables, except in mechanical rooms and areas where other conduits and piping are exposed.

7. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-coded cable with cable diagrams may be used to accomplish cable identification.

8. Grounding: ground electrical systems per manufacturer's written requirements for proper and safe operation.

C. Install Sensors and Controls:

1. Temperature Sensors:

a. Install all sensors and instrumentation according to manufacturer's written instructions. Temperature sensor locations shall be readily accessible, permitting quick replacement and servicing of them without special skills and tools.

b. Calibrate sensors to accuracy specified, if not factory calibrated.

c. Use of sensors shall be limited to its duty, e.g., duct sensor shall not be used in lieu of room sensor.

d. Install room sensors permanently supported on wall frame. They shall be mounted at 1.5 meter (5.0 feet) above the finished floor unless otherwise noted on the plans or drawings.

e. Mount sensors rigidly and adequately for the environment within which the sensor operates. Separate extended-bulb sensors form contact with metal casings and coils using insulated standoffs.

f. Sensors used in mixing plenum, and hot and cold decks shall be of the averaging of type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.

g. All pipe mounted temperature sensors shall be installed in wells.

h. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor reading.

i. Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.

2. Pressure Sensors:

a. Install duct static pressure sensor tips facing directly downstream of airflow.

b. Install high-pressure side of the differential switch between the pump discharge and the check valve.
c. Install snubbers and isolation valves on steam pressure sensing devices.

3. Actuators:
   a. Mount and link damper and valve actuators according to manufacturer's written instructions.
   b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed position.
   c. Check operation of valve/actuator combination to confirm that actuator modulates valve smoothly in both open and closed position.
4. Flow Switches:
   a. Install flow switch according to manufacturer's written instructions.
   b. Mount flow switch a minimum of 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.
2. Third party interfaces: Contractor shall integrate real-time data from building systems by other trades and databases originating from other manufacturers as specified and required to make the system work as one system.

E. Installation of digital controllers and programming:
1. Provide a separate digital control panel for each major piece of equipment, such as air handling unit, chiller, pumping unit etc. Points used for control loop reset such as outdoor air, outdoor humidity, or space temperature could be located on any of the remote control units.
2. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25 percent of available memory free for future use.
3. System point names shall be human readable, permitting easy operator interface without the use of a written point index.
4. Provide software programming for the applications intended for the systems specified, and adhere to the strategy algorithms provided.
5. Provide graphics for each piece of equipment and floor plan in the building. This includes each chiller, cooling tower, air handling unit, fan, terminal unit, boiler, pumping unit etc. These

graphics shall show all points dynamically as specified in the point list. Provide graphics for each piece of equipment and floor plan in the building. This includes each chiller, air handling unit, fan, terminal unit, pumping unit etc. These graphics shall show all points dynamically as specified in the point list. Provide floor plan graphics for all floors of building where any new DDC system component is added under this project (control device, sensor, DDC-controlled equipment, DDC control panels, etc.), to show location of component within building. Entire extents of each floor plan, whether overall floor plan or larger scale floor plan of smaller area of building, shall be viewable on a single screen without scrolling. Overall floor plan of each floor shall be displayed. In cases where the building is too large to legibly show zone information/equipment locations on the overall floor plan, floor plan shall be subdivided into smaller areas at a larger scale to eliminate congestion on the screen, so that pertinent information (room identification data, control setpoints and current values, etc.) are easily readable. Larger scale floor plan graphics shall be linked from overall floor plan, to “drill down” to desired area of building. Floor plan graphics shall show all alarms with color or other visual indicator, and shall indicate thermal comfort conditions on each floor, using dynamic colors to represent zone temperature relative to setpoint matching existing VA color scheme (i.e. green if within setpoint range, red if out of setpoint range)(coordinate with COR). Point/object information on floor plans shall dynamically update. Floor plan graphics shall graphically indicate control zoning areas (rooms served by each piece of terminal equipment). Obtain floor plan CAD files during construction, from engineer of record – provide a minimum of 14 days notice in advance of anticipated need for files. CAD file floor plans provided by engineer will include room identification data (names and/or numbers), which shall be displayed for room identification by VA maintenance personnel. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Intent is to show location of control components within building, show zoning, and visually summarize alarms and anomalies within the system on a building floor plan.

6. In addition to the adjustments and fine tuning, include as a part of this contract the equivalent of two (2) man days (16 hours) of service technician and/or programming time for work as may be specified by the Engineer.

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 be submitted for review with the control system submittal as indicated in paragraph 1.7 Submittals. Test Plan shall address 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 COR 30 days prior to start of performance verification tests. Provide draft copy of operation and maintenance manual with performance verification test.

2. After approval of the validation test plan, installer shall carry out all tests and procedures therein. Installer shall completely check out, calibrate, and test all connected hardware and software to ensure that system performs in accordance with approved specifications and sequences of operation submitted. Installer shall complete and submit Test Check List.

C. Demonstration

1. System operation and calibration shall be demonstrated by the installer in the presence of the CxA, COR, or other VA representative on random samples of equipment as dictated by the COR. Should random sampling indicate improper work, the COR reserves the right to subsequently witness complete calibration of the system at no addition cost to the VA.
2. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.
3. The following witnessed demonstrations of field control equipment shall be included:
   a. Observe HVAC systems in shut down condition. Check dampers and valves for normal position.
   b. Test application software for its ability to communicate with digital controllers, operator workstation, and uploading and downloading of control programs.
   c. Demonstrate the software ability to edit the control program off-line.
   d. Demonstrate reporting of alarm conditions for each alarm and ensure that these alarms are received at the assigned locations.
   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 COR 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.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 8 hours to instruct each VA personnel responsible in the operation and maintenance of the system.

3.5 CONSTRUCTION WASTE MANAGEMENT

A. General: Comply with Contractor's Waste Management Plan and Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.

B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

----- END -----

SECTION 23 21 13
HYDRONIC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Water piping to connect HVAC equipment, including the following:
   1. Chilled water, heating hot water and drain piping.
   2. Extension of domestic water make-up piping for HVAC systems.
   3. Factory prefabricated (preinsulated) chilled water piping for underground service.

B. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

C. Piping systems shall conform to ANSI and State rules for pressure piping where applicable. Welders and fitters shall be fully certified for work performed.

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 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

F. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

G. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

H. Section 23 25 00, HVAC WATER TREATMENT.

I. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA 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)

B16.5-2020 ..... 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, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500

B16.39-2019 ..... Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300

B16.42-2016 ..... Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300

B31.9-2020 ..... Building Services Piping

B40.100-2013 ..... Pressure Gauges and Gauge Attachments

ASME Boiler and Pressure Vessel Code (BPVC):

BPVC Section VIII-2021 ..... Rules for Construction of Pressure Vessels, Division 1

C. 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

A106/A106M-2019a ..... 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(R2020)..... Standard Specification for Carbon Steel Track Bolts and Nuts

A216/A216M-2021 ..... Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

A307-2021 ..... Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength

A536-1984(R2019e1)..... Standard Specification for Ductile Iron Castings

B62-2017 ..... Standard Specification for Composition Bronze or Ounce Metal Castings

B88-2020 ..... Standard Specification for Seamless Copper Water Tube

F439-2019 ..... Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80

F441/F441M-2020 ..... Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

D. American Welding Society (AWS):

B2.1/B2.1M-2014..... Specification for Welding Procedure and Performance Qualification

E. Expansion Joint Manufacturer's Association, Inc. (EJMA):
EJMA 2017 ..... Standards of the Expansion Joint Manufacturers Association, Tenth Edition

F. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:
SP-67-2017..... Butterfly Valves
SP-70-2011..... Gray Iron Gate Valves, Flanged and Threaded Ends
SP-71-2018..... Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-80-2019..... Bronze Gate, Globe, Angle, and Check Valves
SP-85-2011..... Gray Iron Globe and Angle Valves, Flanged and Threaded Ends
SP-110-2010..... Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
SP-125-2018..... Check Valves: Gray Iron and Ductile Iron, In-line, Spring-Loaded, Center-Guided

G. National Fire Protection Association (NFPA):
70-2020 ..... National Electrical Code (NEC)

H. Tubular Exchanger Manufacturers Association (TEMA):
TEMA Standards 2019..... 10th Edition

I. Federal Specifications (Fed. Spec.):
HH-I-558C-92 ..... Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube covering), And Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type)
L-C-530-87 ..... Coating, Pipe, Thermoplastic Resin or Thermosetting Epoxy
RR-F-621E-89 ..... Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

J. Military Specifications (Mil. Spec.):
MIL P 28584B-89 ..... Pipe and Pipe Fittings, Glass Fiber Reinforced Plastic, Adhesive

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.
7. Strainers.
8. Flexible connectors for water service.
9. Pipe alignment guides.
10. Expansion joints.
11. All specified hydronic system components.
12. Gauges.
13. Electric heat tracing systems.
14. Thermometers and test wells.
15. Factory preinsulated piping components and installation instructions.
16. Pipe fittings for preinsulated chilled water piping.

D. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:
   1. Air separators.
   2. Expansion tanks.

E. Manufacturer's certificates for underground preinsulated chilled water piping:
   1. That the field representative for the factory insulated pipe installation is technically qualified and experienced in installation of the manufacturer's system and is qualified to provide the required site reports.
   2. Upon completion of the work and before final acceptance, the Contractor shall deliver a notarized statement, signed by a principal officer of both the manufacturing firm and the contracting firm, stating that the installation is satisfactory and in accordance with the plans, specifications, and manufacturer's standards.

F. Submit the welder’s qualifications in the form of a current (less than 1-year old) and formal certificate.

G. Coordination Drawings: Refer to paragraph, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

H. As-Built Piping Diagrams: Provide drawings as follows for chilled water, and heating hot water system and other piping systems and equipment.
   1. 1wall-mounted stick file with complete set of prints. Mount stick file in the chiller plant or control room along with control diagram stick file.
   2. 1 complete set of reproducible drawings.
   3. 1 complete set of drawings in electronic AutoCAD and pdf format.

I. 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.

1.5 QUALITY ASSURANCE

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC, which includes welding qualifications.

B. Design Working Pressure for Preinsulated Chilled Water Piping: 861 lPa (125 psig).Submit prior to welding of steel piping a certificate of Welder's certification. The certificate shall be current and not more than 1-year old.

C. All couplings, fittings, valves, and specialties shall be the products of a single manufacturer.
   1. All castings used for coupling housings, fittings, and valve bodies, shall be date stamped for quality assurance and traceability.

D. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

E. Manufacturers Training Service: The Contractor shall obtain the services of an independent trained representative of the preinsulated chilled water pipe system manufacturer to instruct contractor's work force in installation procedures for all preinsulated, prefabricated systems.

F. On Site Supervision of Underground Preinsulated Chilled Water Piping Installation:
   1. Provide services of a factory trained representative of the pipe manufacturer during pre-installation, installation and testing periods.

G. Representative's daily written reports to the COR: Present the original of each report on the day it is prepared and forward a copy to the manufacturer's main office. The report shall be signed by the manufacturer's representative. The report shall state whether or not the condition and quality of the materials used and the installation of the system is in accordance with the plans, specifications, and published standards of the manufacturer, and is satisfactory in all respects. If anything connected with the installation is unsatisfactory, the report shall state that corrective action has been taken or shall contain the manufacturer's recommendations for corrective action. The report shall cover any condition that could result in an unsatisfactory installation. The representative shall take prompt action to return to the factory all damaged and defective material, and shall order prompt replacement of such material.

H. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.7 SPARE PARTS

A. For mechanical pressed sealed fittings provide tools required for each pipe size used at the facility.

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES

A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.2 PIPE AND TUBING

A. Chilled Water, Heating Hot Water, and Vent Piping:
   1. Steel: ASTM A53/A53M Grade B, seamless or ERW, Schedule 40.
   2. Copper Water Tube Option: ASTM B88, Type K or L, hard drawn.
   3. Chilled water piping underground: Factory prefabricated (preinsulated) chilled water piping.

B. Extension of Domestic Water Make-up Piping: ASTM B88, Type K or L, hard drawn copper tubing.

C. Cooling Coil Condensate Drain Piping:
   1. From Air Handling Units: Copper water tube, ASTM B88, Type M.
   2. From Fan Coil or Other Terminal Units: Copper water tube, ASTM B88, Type M for runouts and Type L for mains.

D. Pipe supports, including insulation shields, for aboveground piping: Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.3 FITTINGS FOR STEEL PIPE

A. 50 mm (2 inches) and Smaller: Screwed or welded joints.
   1. Butt Welding: ASME B16.9 with same wall thickness as connecting piping.
   2. Forged Steel, Socket Welding or Threaded: ASME B16.11.
   3. Screwed: 150-pound malleable iron, ASME B16.3. 125-pound cast-iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is prohibited.
   4. Unions: ASME B16.39.
   5. Water Hose Connection Adapter: Brass, pipe thread to 19 mm (3/4 inch) garden hose thread, with hose cap nut.

B. 63 mm (2-1/2 inches) and Larger: Welded or flanged joints.
   1. Butt Welding Fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
   2. Welding Flanges and Bolting: ASME B16.5:
      a. Water Service: Weld neck or slip-on, plain face, with 3.2 mm (1/8 inch) thick full-face neoprene gasket suitable for 104 degrees C (220 degrees F).
         1) Contractor's Option: Convoluted, cold formed 150-pound steel flanges, with Teflon gaskets, may be used for water service.
      b. Flange Bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.
C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets shall be used for branch connections up to 1 pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 shall be used for drain, vent, and gauge connections.

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. Mechanically Formed Tee Connection In Water and Drain Piping: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than 3 times the thickness of tube wall. Adjustable collaring device shall ensure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting.
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. 63 mm (2-1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42. Dielectric gasket material shall be compatible with hydronic medium.
D. Temperature Rating: 99 degrees C (210 degrees F).
E. Contractor’s Option: On pipe sizes 50 mm (2 inch) and smaller, screwed end brass ball valves may be used in lieu of dielectric unions.

2.6 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 prohibited.

B. All valves of the same type shall be products of a single manufacturer.

C. Provide chain operators for valves 152 mm (6 inches) and larger when the centerline is located 2.4 m (8 feet) or more above the floor or operating platform.

D. Shut-Off Valves:

1. Ball Valves (Pipe Sizes 50 mm (2 inch) and Smaller): MSS SP-110, screwed or solder connections, brass or bronze body with chrome-plated ball with full port and Teflon seat at 2758 kPa (400 psig working pressure rating. Provide stem extension to allow operation without interfering with pipe insulation.

2. Butterfly Valves (Pipe Sizes 63 mm (2-1/2 inch) and Larger): Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation. MSS SP-67, flange lug type rated 1200 kPa (175 psig) working pressure at 93 degrees C (200 degrees F). Valves shall be ANSI Leakage Class VI and rated for bubble tight shut-off to full valve pressure rating. Valve shall be rated for dead end service and bi-directional flow capability to full rated pressure. Butterfly valves are prohibited for direct buried pipe applications.

   a. Body: Cast-iron, ASTM A126, Class B. Malleable iron, ASTM A47/A47M electro-plated, or ductile iron, ASTM A536, Grade 65-45-12 electro-plated.

   b. Trim: Bronze, aluminum bronze, or 300 series stainless-steel disc, bronze bearings, 316 stainless-steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.

3. Field Interchangeable Actuators: Valves for balancing service shall have adjustable memory stop to limit open position.

   a. Valves 152 mm (6 inches) and Smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.

   b. Valves 203 mm (8 inches) and Larger: Enclosed worm gear with handwheel, and where required, chain-wheel operator.

E. Globe and Angle Valves:

1. Globe Valves:

   a. 50 mm (2 inches) and Smaller: MSS SP-80, bronze, 1034 kPa (150 psig) Globe valves shall be union bonnet with metal plug type disc.

   b. 63 mm (2-1/2 inches) and Larger: 860 kPa (125 psig), flanged, iron body, bronze trim, MSS SP-85 for globe valves.

2. Angle Valves:
   a. 50 mm (2 inches) and Smaller: MSS SP-80, bronze, 1034 kPa (150 psig) Angle valves shall be union bonnet with metal plug type disc.
   b. 63 mm (2-1/2 inches) and Larger: 860 kPa (125 psig), flanged, iron body, bronze trim, MSS SP-85 for angle.

F. Check Valves:
   1. Swing Check Valves:
      a. 50 mm (2 inches) and Smaller: MSS SP-80, bronze, 1034 kPa (150 psig), 45-degree swing disc.
      b. 63 mm (2-1/2 inches) and Larger: 860 kPa (125 psig), flanged, iron body, bronze trim, MSS SP-71 for check valves.
   2. Non-Slam or Silent Check Valve: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut-off. Provide where check valves are shown in chilled water and hot water piping. Check valves incorporating a balancing feature may be used.
      a. Body: MSS SP-125 cast-iron, ASTM A126, Class B, or steel, ASTM A216/A216M, Class WCB, or ductile iron, ASTM 536, flanged or wafer type.
      b. Seat, Disc and Spring: 18-8 stainless-steel, or bronze, ASTM B62. Seats may be elastomer material.

G. Water Flow Balancing Valves: For flow regulation. Provide separate isolation valve. Valves shall be sized to provide the needed pressure drop in the middle of their throttling range.
   1. Ball Globe style valve.
   2. A dual-purpose flow balancing valve and adjustable flow meter, with bronze or cast-iron body, calibrated position pointer, valved pressure taps or quick disconnects with integral check valves and preformed polyurethane insulating enclosure.
   3. Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

H. Automatic Balancing Control Valves: Factory calibrated to maintain constant flow (plus or minus five percent) over system pressure fluctuations of 28 to 393 kPa (4 to 57 psig). Provide standard pressure taps and 4 sets of capacity charts. Valves shall be line size and be one of the following designs:
   1. Gray iron ASTM A126 or brass body rated 1200 kPa (175 psig) at 93 degrees C (200 degrees F), with stainless-steel piston and spring.
   2. Brass or ferrous body designed for 2070 kPa (300 psig) service at 121 degrees C (250 degrees F), with corrosion resistant, tamper proof, self-cleaning piston/spring assembly that is easily removable for inspection or replacement.

3. Combination assemblies containing ball type shut-off valves, unions, flow regulators, strainers with blowdown valves and pressure temperature ports shall be acceptable.
4. Provide a readout kit including flow meter, probes, hoses, flow charts and carrying case.
5. Provide an 18-month cartridge exchange service to allow commissioning of the system due to pressure or flow change requirements.

I. Manual Radiator/Convector Valves: Brass, packless, with position indicator.

2.8 STRAINERS

A. Basket or Y Type.
   1. Screens: Bronze, Monel metal or 18-8 stainless-steel, free area not less than 2-1/2 times pipe area, with perforations as follows: 1.1 mm (0.045 inch) diameter perforations for 100 mm (4 inches) and larger: 3.2 mm (1/8 inch) diameter perforations.

2.9 HYDRONIC SYSTEM COMPONENTS

A. Tangential Air Separator: ASME BPVC Section VIII construction for 861 kPa (125 psig) working pressure, flanged tangential inlet and outlet connection, internal perforated stainless-steel air collector tube designed to direct released air into expansion tank, bottom blowdown connection. Provide Form No. U-1. If scheduled in the contract documents, provide a removable stainless-steel strainer element having 5 mm (3/16 inch) perforations and free area of not less than five times the cross-sectional area of connecting piping.

B. Diaphragm/Bladder Type Pre-Pressurized Expansion Tank: ASME BPVC Section VIII construction for 861 kPa (125 psig) working pressure, welded steel shell, rustproof coated, with a flexible elastomeric diaphragm/bladder suitable for a maximum operating temperature of 115 degrees C (240 degrees F). Provide Form No. U-1. Tank shall be equipped with system connection, drain connection, standard air fill valve and be factory pre-charged to a minimum of 83 kPa (12 psig).

C. Pressure Reducing Valve (Water): Diaphragm or bellows operated, spring loaded type, with minimum adjustable range of 28 kPa (4 psig) above and below set point. Bronze, brass or iron body and bronze, brass or stainless-steel trim, rated 861 kPa (125 psig) working pressure at 107 degrees C (225 degrees F).

D. Pressure Relief Valve: Bronze or iron body and bronze or stainless-steel trim, with testing lever. Comply with ASME BPVC Section VIII and bear ASME stamp.

E. Automatic/Manual Air Vent Valves: Where shown on drawings and required by Section 3.1, cast-iron or semi-steel body, 1034 kPa (150 psig) working pressure, stainless-steel float, valve, valve seat and mechanism, minimum 13 mm (1/2 inch) water connection and 6 mm (1/4 inch) air outlet. Air outlet shall be piped to the nearest floor drain.

2.10 WATER FILTERS AND POT CHEMICAL FEEDERS

A. See Section 23 25 00, HVAC WATER TREATMENT, paragraph, CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS.

2.11 GAUGES, PRESSURE AND COMPOUND

A. ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound for air, oil or water), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 114 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.

B. Provide brass lever handle union cock. Provide brass/bronze pressure snubber for gauges in water service.

C. Range of Gauges: Provide range equal to at least 130 percent of normal operating range.

2.12 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.

B. Provide one each of the following test items to the COR:

1. 6 mm (1/4 inch) FPT by 3.2 mm (1/8 inch) diameter stainless-steel pressure gauge adapter probe for extra-long test plug.
2. 89 mm (3-1/2 inch) diameter, one percent accuracy, compound gauge, 101 kPa (29.5 inches Hg) to 689 kPa (100 psig) range.
3. 0 to 104 degrees C (32 to 220 degrees F) pocket thermometer 1% accuracy, 25 mm (1 inch) dial, 127 mm (5 inch) long stainless-steel stem, plastic case.

2.13 THERMOMETERS

A. Organic liquid filled type, red or blue column, clear plastic window, with 152 mm (6 inch) brass stem, straight, fixed or adjustable angle as required for each in reading.

B. Case: Chrome plated brass or aluminum with enamel finish.

C. Scale: Not less than 228 mm (9 inches), range as described below, 2-degree graduations.

D. Separable Socket (Well): Brass, extension neck type to clear pipe insulation.

E. Scale Ranges:

1. Chilled Water: 0 to 38 degrees C (32 to 100 degrees F).
2. Hot Water: 38 to 93 degrees C (100 to 200 degrees F).

2.14 FIRESTOPPING MATERIAL

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.15 ELECTRICAL HEAT TRACING SYSTEMS

A. Systems shall meet requirements of NFPA 70.

B. Provide tracing for outdoor piping subject to freezing temperatures below 3.3 degrees C (38 degrees F) as follows:
   1. Chilled water piping exposed to the weather.
C. Heat tracing shall be provided to the extent shown in the contract documents(Floor plans and Elevations). Heat tracing shall extend below grade to below the defined frost line.
D. Heating Cable: Flexible, parallel circuit construction consisting of a continuous self-limiting resistance, conductive inner core material between two parallel copper bus wires, designed for cut-to-length at the job site and for wrapping around valves and complex fittings. Self-regulation shall prevent overheating and burnouts even where the cable overlaps itself.
   1. Provide end seals at ends of circuits. Wire at the ends of the circuits is not to be tied together.
   2. Provide sufficient cable, as recommended by the manufacturer, to keep the pipe surface at 2.2 degrees C (36 degrees F) minimum during winter outdoor design temperature, but not less than the following:
      a. 75 mm (3 inch) pipe and smaller with 25 mm (1 inch) thick insulation: 4 watts per foot of pipe.
      b. 100 mm (4 inch) pipe and larger 38 mm (1-1/2 inch) thick insulation: 8 watts per feet of pipe.
E. Electrical Heating Tracing Accessories:
   1. Power supply connection fitting and stainless-steel mounting brackets. Provide stainless-steel worm gear clamp to fasten bracket to pipe.
   2. 13 mm (1/2 inch) wide fiberglass reinforced pressure sensitive cloth tape to fasten cable to pipe at 305 mm (12 inch) intervals.
   3. Pipe surface temperature control thermostat: Cast aluminum, NEMA 4 (watertight) enclosure, 13 mm (1/2 inch) NPT conduit hub, SPST switch rated 20 amps at 480 volts ac, with capillary and copper bulb sensor. Set thermostat to maintain pipe surface temperature at not less than 1 degree C (34 degrees F).
   4. Signs: Manufacturer's standard (NFPA 70), stamped "ELECTRIC TRACED" located on the insulation jacket at 3 m (10 feet) intervals along the pipe on alternating sides.

2.16 FACTORY PREFABRICATED (PREINSULATED) CHILLED WATER PIPING

A. Description:
   1. Underground chilled water supply and return piping shall be HDPE jacketed steel conduit. The system supplier shall have fabricated systems of the composition defined herein for at least five years. All straight sections, fittings, anchors, and other accessories shall be factory prefabricated to job dimensions and designed to minimize the number of field welds. Each system layout shall be computer analyzed by the piping system manufacturer to determine stresses and movements of the service pipe. The system design shall be in strict conformance

with ANSI B31.1 latest edition and stamped by a registered professional engineer. Factory trained field technical assistance shall be provided for the critical periods of the installation; i.e., unloading, field joint instruction and testing.

2. Supplier shall make complete computer analyzed system layout. The system shall include straight sections, fittings, anchors, expansion provision, and building entrance details. The system shall be in conformance with ANSI B31.1. Means for expansion shall be made in pipe offsets or loops unless this is compensated for integrally in the system.

B. Inner Carrier Pipe:

1. Steel pipe: ASTM A53 Grade B, ERW carbon steel. Pipe up through 300 mm (12 inch) diameter shall be standard weight. Wall thickness for pipe larger than 300 mm (12 inch) diameter shall be not less than 10 mm (0.375 inch). Pipe larger than 50 mm (2 inches) shall be joined by welding.

C. Outer Casing: Outer casing shall be HDPE as specified below:

1. High Density Polyethylene (HDPE): Seamless, in accordance with ASTM D1248, type 3, Class C. PVC or tape materials are not allowed. The minimum thickness of the HDPE jacket shall be as follows:

Casing Outside Diameter	Minimum Thickness
12” and smaller	0.125”
Greater than 12”, less than or equal to 24”	0.150”
Greater than 24”	0.175”

D. Factory Applied Insulation:

1. Foam insulation for prefabricated insulated pipe and fittings shall be polyurethane foam having a density not less than 32 kcm (2 pcf).
   a. Polyurethane foam shall conform to ASTM 591, Type II, formed for conduit, density not less than 32 kg/cubic meter (2 pcf).
   b. The insulation "k" factor shall not exceed the numerical value of 0.025 W/(m.k) (0.17 Btu-inch/h. square feet degree F) at 24 degrees C (75 degrees F) mean temperature in accordance with ASTM C177.
2. Insulation thickness for carrier pipe from 1” to 12” nominal diameter: 1”.
3. The polyurethane foam shall completely fill the annular space between the carrier pipe and the casing and shall be bonded to both. Systems using open cell insulation or non-bonded design shall not be allowed. Manufacturer shall certify that the insulated pipe is free of insulation voids and describe quality control procedure followed to meet this requirement.

E. Field Applied Insulation:

1. Insulation for valves, fittings, field casing closures, if required, and other piping system accessories shall be cellular glass conforming to ASTM C552, calcium silicate conforming to ASTM C533 or polyurethane matching the pipe insulation. Insulation shall be premolded, precut or job fabricated to fit and shall be removable and reusable. Thickness shall match adjacent piping.
2. Buried fittings and accessories shall be factory fabricated. Shrink sleeves shall be provided over casing connection joints.

F. End Seals:

1. General: Each preinsulated section of piping shall have a complete sealing of the insulation to provide permanent water and vapor seal at each end of the preinsulated section of piping. Preinsulated sections of piping modified in the field shall be provided with an end seal which is equivalent to the end seals furnished with the preinsulated section of piping. Provide complete sealing of the insulation at each end of each preinsulated conduit section by one of the following methods:
   a. Carrying the outer casing over tapered pipe insulation ends and extending it to the carrier pipe. Provide sufficient surface bonding area between the casing and the carrier pipe to ensure a permanent water and vapor-resistant seal.
   b. Using specially designed prefabricated caps made of the same material and not less than the same thickness as the casing. Provide sufficient surface bonding area between the cap, and both the casing and carrier pipe, to ensure permanent water and vapor-resistant seal.
   c. Using rubber ring gaskets designed and dimensioned to fit in the annular space between the casing and carrier pipe in such a manner as to ensure a permanent water and vapor-resistant seal.
   d. Using shrink sleeves that shall be either heat shrinkable high temperature rubber or polyethylene material that can be bound to the carrier pipes and casing to ensure a permanent water and vapor-resistant seal.
2. Factory casing and end seal testing and certification:
   a. Testing and certification procedures by an independent testing laboratory shall demonstrate that casings and end seals are capable of resisting penetration of water into the casing and insulation at 60 kPa (20 feet) of head pressure, measured above the highest point of the test sample, subjected over the entire surface of an 2.5 m (8-feet) test sample of prefabricated pipe for not less than 48 hours. Test shall use 24 degrees C (75 degree F) water for chilled water service, while the sample is either buried or encased in dry bedding sand with a minimum of 305 mm (12 inches) of sand all around sample. The carrier pipe size in the test section shall be 75 mm (3 inches) in diameter and shall be restrained during

the test period. The insulation thickness shall not exceed the maximum thickness provided for the piping in the project.

b. Test results for Federal Agency Committee on Underground Heat Distribution System, or similar results may be substituted.

G. Joints:

1. Welded joints: Welded joints between sections of pipe and between pipe and fittings shall be provided. Branch connections shall be made with either welding tees or forged branch outlet fittings attached to the main and reinforced against external strains.
2. Insulating joints and dielectric fittings: Shall be installed where required.

H. Direct Buried Underground Chilled Water Piping

1. Insulation Requirements: Factory insulate all chilled water supply piping, and all chilled water return piping 300 mm (12 inches) in diameter and smaller.
2. Steel pipe fittings:
   a. All steel welding fittings shall conform to ASTM A234.
      1) Butt-weld fittings shall conform to ANSI B16.9.
      2) Long radius butt-weld elbows conforming to ANSI B16.9 shall be used unless specifically waived by the COR.
3. Transitional joints: Make carrier pipe joints between steel and copper with solder-threaded adapters and dielectric unions.
4. Gaskets: Elastomeric seals shall conform to ASTM F477.

2.18 BURIED UTILITY WARNING TAPE

A. Tape shall be 0.1 mm (0.004 inch) thick, 150 mm (6 inches) wide, yellow polyethylene with a ferrous metallic core, acid and alkali-resistant and shall have a minimum strength of 12,000 kPa (1750 psig) lengthwise and 10,300 kPa (1500 psig) crosswise with an elongation factor of 350 percent. Provide bold black letters on the tape identifying the type of system. Tape color and lettering shall be unaffected by moisture and other substances contained in the backfill material.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

B. The contract documents show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost or time to the Government. Coordinate with other trades for space available and relative location of HVAC equipment and

accessories to be connected on ceiling grid. Pipe location in the contract documents shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

C. Provide access panels (ceiling, wall, etc.) as required for any items that are inaccessible and require access, such as for operating, cleaning, servicing, maintenance, and calibration.

D. 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.

E. Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1. Install heat exchangers at height sufficient to provide for installation of traps and to allow gravity flow of condensate to the flash tank and condensate pump.
2. Install cooling coils at a height sufficient to provide for installation of condensate drain trap to allow for gravity flow of condensate drain piping.

F. Install piping generally parallel to walls and column center lines, unless shown otherwise in the contract documents. Space piping, including insulation, to provide 25 mm (1 inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope drain piping down in the direction of flow not less than 25 mm (1 inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.

G. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally, locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown in the contract documents. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

H. 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 appropriate.

I. 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.

J. 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.

K. Connect piping to equipment as shown in the contract documents. Install components furnished by others such as:

1. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.

L. Thermometer Wells: In pipes 63 mm (2-1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.

M. 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.

N. Where copper piping is connected to steel piping, provide dielectric connections.

O. Install piping in a first-class manner (plumb and neat).

3.2 PIPE JOINTS

A. Welded: Beveling, spacing and other details shall conform to ASME B31.9 and AWS B2.1/B2.1M. See Welder's qualification requirements in paragraph QUALITY ASSURANCE of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Screwed: Threads shall conform to ASME B1.20.1; joint compound shall be applied to male threads only and joints made up so no more than 3 threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

C. 125 Pound Cast-Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast-iron flange.

D. Solvent Welded Joints: As recommended by the manufacturer.

3.3 LEAK TESTING ABOVEGROUND PIPING

A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the COR. Tests shall be either of those below, or a combination, as approved by the COR.

B. An operating test at design pressure, and for hot systems, design maximum temperature.

C. A hydrostatic test at 1.5 times design pressure for a minimum duration of 6 hours for the new piping systems Valve off existing piping systems as necessary. 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) need not be field tested. Isolate equipment where necessary to avoid excessive pressure on mechanical seals and safety devices.

3.4 FLUSHING AND CLEANING PIPING SYSTEMS

A. Water Piping: Clean systems as recommended by the suppliers of chemicals specified in Section 23 25 00, HVAC WATER TREATMENT.

B. Initial Flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge

from system. Sectionalize system to obtain debris carrying velocity of 1.8 m/s (5.9 f/s), if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the COR.

C. Cleaning: Using products supplied in Section 23 25 00, HVAC WATER TREATMENT, circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 1.8 m/s (5.9 f/s). Circulate each section for not less than 4 hours. Blow-down all strainers or remove and clean as frequently as necessary. Drain and prepare for final flushing.

D. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

3.5 WATER TREATMENT

A. Install water treatment equipment and provide water treatment system piping.

B. Close and fill system as soon as possible after final flushing to minimize corrosion.

C. Charge systems with chemicals specified in Section 23 25 00, HVAC WATER TREATMENT.

D. Utilize this activity, by arrangement with the COR, for instructing VA operating personnel.

3.6 ELECTRIC HEAT TRACING

A. Install tracing as recommended by the manufacturer.

B. Coordinate electrical connections.

3.7 INSTALLATION OF PREINSULATED CHILLED WATER PIPING

A. Handling and Storage: Handle and store conduits, pipes, and all accessories to ensure complete installation in a sound undamaged condition. Unloading, tacking, moving, and storing of materials shall be in strict accordance with the manufacturer's requirements. Take special care to ensure that materials which have exceeded their specified shelf life are not used in the installation of the system. Before installation all materials shall be inspected for defects. Materials found to be defective before or after installation shall be repaired or replaced with sound material, with no additional expense to the Government.

B. Installation of Piping Systems:

1. Piping system furnished shall be installed in accordance with the piping system manufacturer's instructions. Piping shall be installed without springing or forcing other than what has been

calculated for thermal expansion and contraction. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints or hangers. Nonmetallic pipe cut in the field shall be machined to fit couplings or joints and shall be coated or treated to match standard factory coated ends. Copper tubing shall not be installed in the same trench with ferrous piping materials. When nonferrous metallic pipe (e.g., copper tubing) crosses any ferrous piping material, a minimum vertical separation of 300 mm (12 inches) shall be maintained between pipes. Connections between different types of pipe and accessories shall be made with transition fittings approved by the manufacturer of the piping system.

2. Pitching of horizontal piping: Horizontal piping shall be pitched at a grade not less than 25 mm (1 inch) in 12 m (40 feet) toward the drain points unless otherwise indicated.

3. Install vacuum and air relief valves, as required, for filling and draining of the system.

C. Pipe Sleeves:

1. Pipe shall be continuous through sleeves. Set in place before concrete is poured.
2. Seal between sleeve and core opening with modular mechanical type link seal.
3. Provide where water lines pass through retaining walls and foundation walls.

D. Cutting of Prefabricated Conduit Sections: Prefabricated conduit sections shall be cut in strict accordance with the manufacturer's recommendations and standards. The cut section shall be treated as required to result in the cut section being identical in every respect to a standard conduit section produced at the factory.

E. Field Casing Closures: Field insulation and encasement of joints shall be accomplished after the visual and pressure tests specified are completed. Field insulation and encasement shall be in accordance with the manufacturer's written instructions. Thickness dimensions of the insulation and casing materials shall not be less than those of the adjoining prefabricated section. Insulating material shall be foamed in place polyurethane. Care shall be taken to ensure that field closures are made under conditions of temperature and cleanliness required to produce a sound continuous vapor barrier. A standard polyethylene heat shrink sleeve shall be installed over the casing and shall have a 150 mm (6-inch minimum) overlap at each end.

F. Insulation and Encasement of Pipe Accessories: Flanges, couplings, unions, valves, fittings, and other pipe accessories, unless otherwise shown or approved, shall be insulated with removable factory premolded, prefabricated or field fabricated insulation. For accessories buried underground, the casing material and thickness shall be identical to that of the adjoining casing material and thickness shall be identical to that of the adjoining casing except that for HDPE casing larger than 300 mm (12-inch) size, the casing material over fittings shall be reinforced thermosetting resin (RTRP). Where accessories are designated not to be insulated, the adjoining insulation and jacket shall terminate neatly and in a manner to provide a complete vapor seal.

G. Trenching and Backfilling: Trench bottoms for underground prefabricated conduit systems shall be smooth and free of sharp objects, stones, and debris that could puncture the casing. Where this is a problem, the trench shall be over excavated and stabilized by using sand, fine dirt, or similar material. Partial backfilling is required immediately after installation of the pipe. Selected backfill shall be tamped in not more than 150 mm (6 inch) layers under and around the conduit to a height of not less than 150 mm (6-inch) above the top of the casing. During this process, joints shall be left exposed for visual inspection during field tests.

H. Open Ends: Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt and other foreign matter out of the system.

I. Vapor Barrier: Install materials to provide and preserve the integrity of the vapor barrier.

3.8 TESTING UNDERGROUND PREINSULATED CHILLED WATER PIPING

A. First Hydrostatic Test:

1. All distribution piping shall be tested hydrostatically, before backfilling, with the joints of the water carrier pipe exposed. Installation of thrust blocks prior or after hydrostatic testing shall be as recommended by the pipe manufacturer's installation instructions.
2. Each test cycle shall consist of a 10 minute period at 1034 kPa (150 psig) followed by a 5 minute period at a pressure less than 345 kPa (50 psig). The next cycle shall begin immediately following the completion of the previous cycle. Pressure rise and drop shall not exceed 690 kPa (100 psig) per minute. The pressure gage shall be located and the pressure measured at the opposite end of the system from where the pressure is applied. After completion of the hydrostatic pressure cycling the first hydrostatic pressure test shall be performed.

B. Final Hydrostatic Test: After successful completion of the first hydrostatic test, the system shall be pressurized to 1-1/2 times the working pressure up to 1034 kPa (150 psig). This pressure shall be held for a minimum of 4 hours. The method of pressurizing the piping system is to disconnect it from the system prior to the start of the 4-hour pressure holding period. If the pressure cannot be held for the specified length of time, the cause of the pressure loss shall be determined, corrected, and all the tests be repeated.

C. Repair joints, replace damaged or porous pipe and fittings and repeat the test without additional cost or time to the Government until the system can be demonstrated to have no leakage.

3.9 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

D. Adjust red set hand on pressure gauges to normal working pressure.

3.10 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 8 hours to instruct each VA personnel responsible in operation and maintenance of the system.

- - - E N D - - -

SECTION 23 21 23
HYDRONIC PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Hydronic pumps for heating, ventilating and air conditioning.

B. Definitions:

1. Capacity: Liters per second (L/s) (Gallons per minute (gpm)) of the fluid pumped.
2. Head: Total dynamic head in kPa (feet) of the fluid pumped.
3. Flat head-capacity curve: Where the shutoff head is less than 1.16 times the head at the best efficiency point.

C. Pumps shall be tested and rated in accordance with Hydraulics Institute standards. Pumps shall comply, and be labeled, with the Department of Energy mandated Pump Energy Index (PEI). Pumps with a PEI greater than 1.0 will not be accepted.

D. 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 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.

F. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

G. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

H. Section 23 21 13, HYDRONIC PIPING.

I. 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 Society of Mechanical Engineers (ASME):

B16.1-2020 ..... Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250

C. American Society for Testing and Materials (ASTM):

A48/48M-2003(R2021)..... Standard Specification for Gray Iron Castings

B62-2017 ..... Standard Specification for Composition Bronze or Ounce Metal Castings

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop drawing submittals shall include the Pump Energy Index (PEI) values or will be subject to rejection without further review.

C. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 21 23, SECTION TITLE”, with applicable paragraph identification.

D. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Pumps and accessories.
2. Motors and drives.
3. Variable speed motor controllers shall be submitted under the appropriate Division 26 specification section. Coordinate requirements with E.C.

E. Characteristic Curves: Head-capacity, efficiency-capacity, brake horsepower-capacity, and NPSHR-capacity for each pump and for combined pumps in parallel or series service. Identify pump and show fluid pumped, specific gravity, pump speed and curves plotted from zero flow to maximum for the impeller being furnished and at least the maximum diameter impeller that can be used with the casing.

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.

1.5 QUALITY ASSURANCE

A. Design Criteria:

1. Pumps design and manufacturer shall conform to Hydraulic Institute Standards. Pumps shall be tested and rated in accordance with Hydraulics Institute Standards. Impellers shall be statically and dynamically balanced after being shaved for the specified duty.
2. Pumps with Electronically Communicated Motors (ECM’s) shall be selected such that the maximum available motor RPM shall at minimum accommodate 10% additional pump GPM at a 21% increase in water pressure drop, over what is specified as the pump duty point. This elevated performance point shall also not exceed the motor’s HP limitations or the pump’s

construction class. Shop drawing information shall reflect these requirements. Motor speeds shall be adjustable in the field, and any hard programmed limitations of motor speed or pump performance shall be based on the required elevated performance stated above.

3. Pump sizes, capacities, pressures, operating characteristics and efficiency shall be as scheduled.
4. Head-capacity curves shall slope up to maximum head at shut-off. Select pumps near the midrange of the curve, so the design capacity falls to the left of the best efficiency point, to allow a cushion for the usual drift to the right in operation, without approaching the pump curve end point and possible cavitation and unstable operation. Select pumps for open systems so that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA). Provide pumps with non-overloading motors.
5. Pump Driver: Furnish with pump. Size shall be non-overloading at any point on the head-capacity curve, including in a parallel or series pumping installation with one pump in operation.
6. Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard and other accessories specified. Statically and dynamically balance all rotating parts.
7. Furnish each pump and motor with a nameplate giving the manufacturers name, serial number of pump, capacity in gpm and head in feet at design condition, horsepower, voltage, frequency, speed and full load current and motor efficiency. Name plates shall be visible when pumps are insulated.
8. Test all pumps before shipment. The manufacturer shall certify all pump ratings.
9. After completion of balancing, provide replacement of impellers or trim impellers to provide specified flow at actual pumping head, as installed.

B. Allowable Vibration Tolerance for Pump Units: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

C. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

D. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.7 SPARE MATERIALS

A. Furnish one spare seal and casing gasket for each pump to the COR.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL PUMPS, BRONZE FITTED

A. General:

1. Provide pumps that will operate continuously without overheating bearings or motors at every condition of operation on the pump curve, or produce noise audible outside the room or space in which installed.
2. Provide pumps of size, type and capacity as indicated, complete with electric motor and drive assembly, unless otherwise indicated. Design pump casings for the indicated working pressure and factory test at 1-1/2 times the designed pressure.
3. Provide pumps of the same type, the product of a single manufacturer, with pump parts of the same size and type interchangeable.
4. General Construction Requirements:
   a. Balance: Rotating parts, statically and dynamically.
   b. Construction: To permit servicing without breaking piping or motor connections.
   c. Pump Motors: Provide high efficiency motors, inverter duty for variable speed service or ECMs where available. Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT. Motors shall be ECM when available, or open drip-proof or TEFC and operate at 1750 RPM, unless noted otherwise.
   d. Heating pumps shall be suitable for handling water to 107 degrees C (225 degrees F).
   e. Provide coupling guards that meet OSHA requirements.
   f. Pump Connections: Flanged.
   g. Pump shall be factory tested.
   h. Performance: As scheduled in the contract documents.
5. Variable Speed Pumps:
   a. The pumps shall be the type shown in the contract documents and specified herein flex coupled to an open drip proof or a TEFC motor.
   b. Variable Speed Motor Controllers: Refer to Section 26 29 11, MOTOR CONTROLLERS and to Section 23 05 11, COMMON WORK RESULTS FOR HVAC paragraph, VARIABLE SPEED MOTOR CONTROLLERS. Division 23 Contractor shall closely coordinate pump and associated motor requirements with the variable speed motor controller furnished by Division 26 Contractor.
   c. Pump operation and speed control shall be as shown in the contract documents.
   d. Direct drive pumps with integrated variable frequency drive (VFD) utilizing the design pump curve programmed on board the built-in controller (also known as sensor-less, or self-sensing). Pump to comply with paragraphs in this section. VFD and motor to comply

with Section 26 29 11, MOTOR CONTROLLERS and Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.

B. Inline Type, Base Mounted End Suction or Double Suction Type:
   1. Casing and Bearing Housing: Close-grained cast-iron, ASTM A48/A48M.
   2. Casing Wear Rings: Bronze.
   3. Suction and Discharge: Plain face flange, 861 kPa (125 psig), ASME B16.1.
   4. Casing Vent: Manual brass cock at high point.
   5. Casing Drain and Gauge Taps: 13 mm (1/2 inch) plugged connections minimum size.
   6. Impeller: Bronze, ASTM B62, enclosed type, keyed to shaft.
   7. Shaft: Steel, Type 1045 or stainless-steel.
   8. Shaft Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPDM bellows and gasket.
   9. Shaft Sleeve: Bronze or stainless-steel.
   10. Motor: Furnish with pump. Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
   11. Base Mounted Pumps:
      a. Designed for disassembling for service or repair without disturbing the piping or removing the motor.
      b. Impeller Wear Rings: Bronze.
      c. Shaft Coupling: Non-lubricated steel flexible type or spacer type with coupling guard, bolted to the baseplate.
      d. Bearings (Double-Suction pumps): Regreaseable ball or roller type.
      e. Provide lip seal and slinger outboard of each bearing.
      f. Base: Cast-iron or fabricated steel for common mounting to a concrete base.
   12. Provide line sized shut-off valve and suction strainer (with blow down valve), and maintain manufacturer recommended straight pipe length on pump suction. Contractor option: Provide suction diffuser as follows:
      a. Body: Cast-iron with steel inlet vanes and combination diffuser-strainer-orifice cylinder with 5 mm (3/16 inch) diameter openings for pump protection. Provide taps for strainer blowdown and gauge connections.
      b. Provide adjustable foot support for suction piping.
      c. Strainer free area: Not less than 5 times the suction piping.
      d. Provide disposable startup strainer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pumps shall be supported with vibration isolators.

B. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

C. Follow manufacturer's written instructions for pump mounting and startup. Access/Service space around pumps shall not be less than minimum space recommended by pumps manufacturer.

D. Provide drains for bases and seals for base mounted pumps, piped to and discharging into floor drains.

E. Coordinate location of thermometer and pressure gauges as per Section 23 21 13, HYDRONIC PIPING.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. Verify that the piping system has been flushed, cleaned and filled.

D. Lubricate pumps before startup.

E. Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.

F. Verify that correct size heaters-motor over-load devices are installed for each pump controller unit.

G. Field modifications to the bearings and or impeller (including trimming) are prohibited. If the pump does not meet the specified vibration tolerance, send the pump back to the manufacturer for a replacement pump. All modifications to the pump shall be performed at the factory.

H. Ensure the disposable strainer is free of debris prior to testing and balancing of the hydronic system.

I. After several days of operation, replace the disposable startup strainer with a regular strainer in the suction diffuser.

3.3 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.

- - - E N D - - -

SECTION 23 22 13
STEAM AND CONDENSATE HEATING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Steam, condensate and vent piping inside buildings.

B. Piping systems shall conform to ANSI rules for pressure piping, where applicable. Welders and fitters shall be fully certified for work performed.

C. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 09 91 00, PAINTING.

E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

F. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

G. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

H. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

I. Section 23 25 00, HVAC WATER TREATMENT.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):

B1.20.1-2013 ..... Pipe Threads, General Purpose (Inch)

B16.5-2013 ..... Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

B16.9-2012 ..... Factory Made Wrought Buttwelding Fittings

B16.11-2011 ..... Forged Fittings, Socket-Welding and Threaded

B16.42-2016 ..... Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300

B31.1-2018 ..... Power Piping

B31.9-2014 ..... Building Services Piping

B40.100-2013 ..... Pressure Gauges and Gauge Attachments

ASME Boiler and Pressure Vessel Code (BPVC) -

BPVC Section II-2019 ..... Materials

BPVC Section VIII-2019 ..... Rules for Construction of Pressure Vessels, Division 1

BPVC Section IX-2019..... Welding, Brazing, and Fusing Qualifications

C. American Society for Testing and Materials (ASTM):

A53/A53M-2017..... 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

A216/A216M-2019..... Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

A285/A285M-2017..... Standard Specification for Pressure Vessel Plates, Carbon Steel, Low-and Intermediate-Tensile Strength

A307-2019..... Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength

A516/A516M-2017..... Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

A536-1984 (R2017)..... Standard Specification for Ductile Iron Castings

B62-2017..... Standard Specification for Composition Bronze or Ounce Metal Castings

D. American Welding Society (AWS):

B2.1/B2.1M-2014..... Specification for Welding Procedure and Performance Qualifications

Z49.1-2012..... Safety in Welding and Cutting and Allied Processes

E. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:

SP-80-2013..... Bronze Gate, Globe, Angle, and Check Valves

F. Military Specifications (Mil. Spec.):

MIL-S-901D-2017..... Shock Tests, H.I. (High Impact) Shipboard Machinery, Equipment, and Systems

G. National Board of Boiler and Pressure Vessel Inspectors (NB):

Relieving Capacities of Safety Valves and Relief Valves

H. Tubular Exchanger Manufacturers Association (TEMA):

TEMA Standards-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 22 13, STEAM AND CONDENSATE HEATING PIPING”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Pipe and equipment supports.
   2. Pipe and tubing, with specification, class or type, and schedule.
   3. Pipe fittings, including miscellaneous adapters and special fittings.
   4. Flanges, gaskets and bolting.
   5. Valves of all types.
   6. Strainers.
   7. All specified steam system components.
   8. Gauges.
   9. Thermometers and test wells.
D. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:
   1. Heat Exchangers (Steam-to-Hot Water).
   2. Flash tanks.
E. Coordination Drawings: Refer to paragraph, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
F. As-Built Piping Diagrams: Provide drawing as follows for steam and steam condensate piping and other central plant equipment.
   1. One wall-mounted stick file for prints. Mount stick file in the chiller plant or adjacent control room along with control diagram stick file.
   2. One set of reproducible drawings.
G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 QUALITY ASSURANCE

A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC, which includes welding qualifications.
B. The products and execution of work specified in this section shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments shall be enforced, along with requirements of local utility companies. The most stringent requirements of these specifications, local codes, or utility company requirements shall always apply. Any conflicts shall be brought to the attention of the COR.

C. Welding Qualifications: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
   1. Qualify welding processes and operators for piping according to ASME BPVC Section IX, AWS Z49.1 and AWS B2.1/B2.1M.
   2. Comply with provisions in ASME B31.9 and ASME B31.1 as applicable.
   3. Certify that each welder and welding operator has passed AWS qualification tests for welding processes involved and that certification is current and recent. Submit documentation to the COR.
   4. All welds shall be stamped according to the provisions of the American Welding Society.

D. ASME Compliance: Comply with ASME B31.9 and ASME B31.1 as applicable for materials, products, and installation. Safety valves and pressure vessels shall bear appropriate ASME labels.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions in electronic version on CD or DVD. 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 shall 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, and valve tag numbers. 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, 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.

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES

A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.2 PIPE AND TUBING

A. Steam Piping: Steel, ASTM A53/A53M, Grade B, seamless or ERW; ASTM A106/A106M Grade B, seamless; Schedule 40.

B. Steam Condensate and Pumped Condensate Piping: Steel, ASTM A53/A53M, Grade B, seamless or ERW; or ASTM A106/A106M Grade B, seamless, Schedule 80.

C. Vent Piping: Steel, ASTM A53/A53M, Grade B, seamless or ERW; ASTM A106/A106M Grade B, seamless; Schedule 40, galvanized.

2.3 FITTINGS FOR STEEL PIPE

A. 50 mm (2 inches) and Smaller: Screwed or welded.

1. Cast iron fittings or piping is not acceptable for steam and steam condensate piping. Bushing reduction or use of close nipples is not acceptable.
2. Forged steel, socket welding or threaded: ASME B16.11, 13,790 kPa (2000 psig) class with ASME B1.20.1 threads. Use Schedule 80 pipe and fittings for threaded joints. Lubricant or sealant shall be oil and graphite or other compound approved for the intended service.
3. Unions: Forged steel, 13,790 kPa (2000 psig) class or 20,685 kPa (3000 psig) class on piping 50 mm (2 inches) and under.
4. Steam line drip station and strainer quick-couple blowdown hose connection: Straight through, plug and socket, screw or cam locking type for 15 mm (1/2 inch) ID hose. No integral shut-off is required.

B. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints.

1. Cast iron fittings or piping is not acceptable for steam and steam condensate piping.
2. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
3. Welding flanges and bolting: ASME B16.5:
   a. Steam service: Weld neck or slip-on, raised face, with non-asbestos gasket. Non-asbestos gasket shall either be stainless steel spiral wound strip with flexible graphite

filler or compressed inorganic fiber with nitrile binder rated for saturated and superheated steam service 400 degrees C (750 degrees F) and 10,342 kPa (1500 psig).

b. Flange bolting: 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 DIELECTRIC FITTINGS

A. Provide where dissimilar metal pipe are joined.

B. 50 mm (2 inches) and Smaller: Threaded dielectric union.

C. 65 mm (2-1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.

D. Temperature Rating, 121 degrees C (250 degrees F) for steam condensate and as required for steam service.

E. Contractor's option: On pipe sizes 50 mm (2 inches) and smaller, screwed end steel gate valves may be used in lieu of dielectric unions.

2.5 VALVES

A. Asbestos packing is not acceptable.

B. All valves of the same type shall be products of a single manufacturer.

C. Provide chain operators for valves 150 mm (6 inches) and larger when the centerline is located 2.1 m (7 feet) or more above the floor or operating platform.

D.

E. Shut-Off Valves:

1. Gate Valves:

a. 50 mm (2 inches) and smaller: Forged steel body, rated for 1380 kPa (200 psig) saturated steam, 2758 kPa (400 psig) WOG, bronze wedges and Monel or stainless-steel seats, threaded ends, rising stem, and union bonnet.

b. 65 mm (2-1/2 inches) and larger: Flanged, outside screw and yoke.

1) High pressure steam 110 kPa (16 psig) and above system): Cast steel body, ASTM A216/A216M grade WCB, 1035 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel solid disc and seats. Provide 25 mm (1 inch) factory installed bypass with globe valve on valves 100 mm (4 inches) and larger and on all steam main shutoff valves, regardless of size.

2) All other services: Forged steel body, Class B, rated for 850 kPa (123 psig) saturated steam, 1380 kPa (200 psig) WOG, bronze or bronze face wedge and seats, 850 kPa (123 psig) ASME flanged ends, OS&Y, rising stem, bolted bonnet, and renewable seat rings.

F. Globe and Angle Valves:

1. Globe Valves:
   a. 50 mm (2 inches) and smaller: Forged steel body, rated for 1380 kPa (200 psig) saturated steam, 2758 kPa (400 psig) WOG, hardened stainless steel disc and seat, threaded ends, rising stem, union bonnet, and renewable seat rings.
   b. 65 mm (2-1/2 inches) and larger:
      1) Globe valves for high pressure steam 110 kPa (16 psig): Cast steel body, ASTM A216/A216M grade WCB, flanged, OS&Y, 1035 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.
      2) All other services: Steel body, rated for 850 kPa (123 psig) saturated steam, 1380 kPa (200 psig) WOG, bronze or bronze-faced disc (Teflon or composition facing permitted) and seat, 850 kPa (123 psig) ASME flanged ends, OS&Y, rising stem, bolted bonnet, and renewable seat rings.
2. Angle Valves:
   a. 50 mm (2 inches) and smaller: Cast steel 1035 kPa (150 psig), union bonnet with metal plug type disc.
   b. 65 mm (2-1/2 inches) and larger:
      1) Angle valves for high pressure steam 110 kPa (16 psig): Cast steel body, ASTM A216/A216M grade WCB, flanged, OS&Y, 1035 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.
      2) All other services: 861 kPa (125 psig), flanged, cast steel body, and bronze trim.

G. Swing Check Valves:
1. 50 mm (2 inches) and smaller: Cast steel, 1035 kPa (150 psig), 45-degree swing disc.
2. 65 mm (2-1/2 inches) and Larger:
   a. Check valves for high pressure steam 110 kPa (16 psig) and above system: Cast steel body, ASTM A216/A216M grade WCB, flanged, OS&Y, 1035 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.
   b. All other services: 861 kPa (125 psig), flanged, cast steel body, and bronze trim.

H. Manual Radiator/Convector Valves: Brass, packless, with position indicator.

2.6 STRAINERS

A. Basket or Y Type. Tee type is acceptable for gravity flow and pumped steam condensate service.
B. High Pressure Steam: Rated 1035 kPa (150 psig) saturated steam.
1. 50 mm (2 inches) and smaller: Cast steel, rated for saturated steam at 1034 kPa (150 psig) threaded ends.

2. 65 mm (2-1/2 inches) and larger: Cast steel rated for 1034 kPa (150 psig) saturated steam with 1034 kPa (150 psig) ASME flanged ends or forged steel with 1724 kPa (250 psig) ASME flanged ends.

C. All Other Services: Rated 861 kPa (125 psig) saturated steam.
1. 50 mm (2 inches) and smaller: Cast steel body.
2. 65 mm (2-1/2 inches) and larger: Flanged, cast steel body.

D. Screens: Bronze, Monel metal or 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows:
1. 75 mm (3 inches) and smaller: 20 mesh for steam and 1.1 mm (0.045 inch) diameter perforations for liquids.
2. 100 mm (4 inches) and larger: 1.1 mm (0.045) inch diameter perforations for steam and 3.2 mm (1/8 inch) diameter perforations for liquids.

2.7 STEAM SYSTEM COMPONENTS

A. Heat Exchanger (Steam to Hot Water): Shell and tube type, U-bend removable tube bundle, steam in shell, water in tubes, equipped with support cradles.
1. Maximum tube velocity: 2.3 m/s (7.5 f/s).
2. Tube fouling factor: TEMA Standards, but not less than 0.00018 m^2K/W (0.001 ft^2hrF/Btu).
3. Materials:
a. Shell: Steel.
b. Tube sheet and tube supports: Steel or brass.
c. Tubes: 20 mm (3/4 inch) OD copper.
d. Head or bonnet: Steel.
4. Construction: In accordance with ASME Pressure Vessel Code for 861 kPa (125 psig) working pressure for shell and tubes. Provide manufacturer's certified data report, Form No. U-1.

B. Optional Heat Transfer Package: In lieu of field erected individual components, the Contractor shall provide a factory or shop assembled package of heat exchangers, pumps, and other components, pre-piped and pre-wired and supported on a welded steel frame or skid.

C. Steam Pressure Reducing Valves in PRV Stations:
1. Type: Single-seated, diaphragm operated, spring-loaded, external or internal steam pilot-controlled, normally closed, adjustable set pressure. Pilot shall sense controlled pressure downstream of main valve.
2. Service: Provide controlled reduced pressure to steam piping systems.
3. Pressure control shall be smooth and continuous with maximum drop of 10percent deviation from set pressure.
4. Maximum flow capacity of the combined PRV valves, or the bypass valve will not exceed capacity of downstream safety valve(s).

5. The bypass valve will be equal to or +10 percent of the combined capacity of the PRV valves.
6. Main valve and pilot valve shall have replaceable valve plug and seat of stainless steel, Monel, or similar durable material.
   a. Pressure rating for high pressure steam: Not less than 1035 kPa (150 psig) saturated steam.
   b. Connections: Flanged for valves 65 mm (2-1/2 inches) and larger; flanged or threaded ends for smaller valves.
7. Select pressure reducing valves to develop less than 85 db(A) at 1.5 m (5 feet) elevation above adjacent floor, and 1.5 m (5 feet) distance in any direction. Inlet and outlet piping for steam pressure reducing valves shall be Schedule 80 minimum for required distance to achieve required levels or sound attenuators shall be applied.

D. Safety Valves and Accessories: Comply with ASME BPVC Section VIII. Capacities shall be certified by National Board of Boiler and Pressure Vessel Inspectors, maximum accumulation 10 percent. Provide lifting lever. Provide drip pan elbow where shown. Valve shall have stainless steel seats and trim.

E. Flash Tanks: Horizontal or vertical vortex type, constructed of copper bearing steel, ASTM A516/A516M or ASTM A285/A285M, for a steam working pressure of 861 kPa (125 psig) to comply with ASME Code for Unfired Pressure Vessels and stamped with "U" symbol. Perforated pipe inside tank shall be ASTM A53/A53M Grade B, seamless or ERW, or ASTM A106/A106M Grade B seamless, Schedule 80. Corrosion allowance of 1.6 mm (1/16 inch) may be provided in lieu of the copper bearing requirement. Provide data Form No. U-1.

F. Steam Trap: Each type of trap shall be the product of a single manufacturer. Provide trap sets at all low points and at 61 m (200 feet) intervals on the horizontal main lines.
   1. Floats and linkages shall provide sufficient force to open trap valve over full operating pressure range available to the system. Unless otherwise indicated on the drawings, traps shall be sized to handle 2.0 times the specified heat transfer load with pressure drop as follows:
      a. For equipment with modulating control valve: 1.7 kPa (1/4 psig), based on a condensate leg of 300 mm (12 inches) at the trap inlet and gravity flow to the receiver.
      b. For main line drip trap sets and other trap sets at steam pressure: Up to 70 percent of design differential pressure. Condensate may be lifted to the return line.
   2. Trap bodies: Steel, constructed to permit ease of removal and servicing working parts without disturbing connecting piping. The use of raised face flange is required on pipe sizes 1.5 inch and above. The use of unions is acceptable for pipe sizes below 1.5 inches. For systems without relief valve traps shall be rated for the pressure upstream of the steam supplying the system.
   3. Balanced pressure thermostatic elements: Phosphor bronze, stainless steel or Monel metal.

4. Valves and seats: Suitable hardened corrosion resistant alloy.
5. Mechanism: Brass, stainless steel or corrosion resistant alloy.
6. Floats: Stainless steel.
7. Inverted bucket traps: Provide bi-metallic thermostatic element for rapid release of non-condensables.

G. Condensate Pump, Pad-Mounted:

1. General: Factory assembled unit consisting of vented receiver tank, duplex motor-driven pumps, interconnecting piping and wiring, motor controls (including starters) and accessories, designed to receive, store, and pump steam condensate up to 210 deg. F. at sea level..
2. Receiver Tank: Floor mounted for low return lines,cast iron with threaded openings for connection of piping and accessories and facilities for mounting float switches.
3. Furnish seals for condensate pump with a minimum temperature rating of 121 degrees C (250 degrees F).
4. Centrifugal Pumps: Bronze fitted with mechanical shaft seals.
   a. Designed to allow removal of rotating elements without disturbing connecting piping or pump casing mounting.
   b. Shafts: Stainless steel, Type 416 or alloy steel with bronze shaft sleeves.
   c. Bearings: Regreaseable ball or roller type.
   d. Casing wearing rings: Bronze.
5. Motors: Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
6. Pump Operation:
   a. Float Switches: NEMA 4, mounted on receiver tank, to start and stop pumps in response to changes in the water level in the receiver and adjustable to permit the controlled water levels to be changed. Floats and connecting rods shall be copper, bronze or stainless steel.
   b. Alternator: Provide for duplex units to automatically start the second pump when the first pump fails in keeping the receiver water level from rising and to alternate the order of starting the pumps to equalize wear. For units 0.25 kW (1/3 hp) and smaller, the alternator may be the mechanical type for use in lieu of float switches.
7. Control Cabinet for 3 Phase (0.37 kW (1/2 hp) and larger) Units: NEMA 4, UL approved, factory wired, enclosing all controls, with indicating lights, manual switches and resets mounted on the outside of the panel. Attach cabinet to the pump set with rigid steel framework, unless remote mounting is noted on the pump schedule.
   a. Motor starters: Magnetic contact types with circuit breakers or combination fusible disconnect switches. Provide low voltage control circuits (120-volt maximum) and HOA switches for each pump.

b. Indicating lights for each pump: Green to show that power is on, red to show that the pump is running.

8. Electric Wiring: Suitable for 94 degrees C (200 degrees F) service; enclosed in liquid-tight flexible metal conduit where located outside of control cabinet.
9. Receiver Accessories:
   a. Thermometer: 38 to 216 degrees C (100 to 420 degrees F), mounted below minimum water level.
   b. Water level gauge glass: Brass with gauge cocks which automatically stop the flow of water when the glass is broken. Provide drain on the lower gauge cock and protection rods for the glass.

H. Thermostatic Air Vent (Steam): Steel body, balanced pressure bellows, stainless steel (renewable) valve and seat, rated 861 kPa (125 psig) working pressure, 20 mm (3/4 inch) screwed connections. Air vents shall be balanced pressure type that responds to steam pressure-temperature curve and vents air at any pressure.

2.8 GAUGES, PRESSURE AND COMPOUND

A. ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 115 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.

B. Provide steel, lever handle union cock. Provide steel or stainless-steel pressure snubber for gauges in water service. Provide steel pigtail syphon for steam gauges.

C. Pressure gauge ranges shall be selected such that the normal operating pressure for each gauge is displayed near the midpoint of each gauge's range. Gauges with ranges selected such that the normal pressure is displayed at less than 30 percent or more than 70 percent of the gauge's range are prohibited. The units of pressure shall be psig.

2.9 PRESSURE/TEMPERATURE TEST PROVISIONS

A. Provide one each of the following test items to the COR:
   1. 6 mm (1/4 inch) FPT by 3.2 mm (1/8 inch) diameter stainless steel pressure gauge adapter probe for extra-long test plug. Pressure/temperature plug is an example.
   2. 90 mm (3-1/2 inch) diameter, one percent accuracy, compound gauge, 762 mm (30 inches) Hg to 690 kPa (100 psig) range.
   3. 0 to 104 degrees C (32 to 220 degrees F) pocket thermometer one-half degree accuracy, 25 mm (1 inch) dial, 125 mm (5 inch) long stainless-steel stem, plastic case.

2.10 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, 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 convertors, steam coils, and other heat exchangers at height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.

E. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (1 inch) minimum clearance between adjacent piping and another surface. Unless shown otherwise, slope steam, condensate and drain piping down in the direction of flow not less than 25 mm (1 inch) in 12 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.

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 appropriate.

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. Tee steam piping runouts or branches into the top of mains or other branches. Avoid horizontal side connections and bottom connections.

J. Connect piping to equipment as shown on the drawings. Install components furnished by others such as flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.

K. 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.

L. Pipe vents to the exterior. Where a combined vent is provided, the cross-sectional area of the combined vent shall be equal to sum of individual vent areas. Slope vent piping 25 mm (1 inch) in 12 m (40 feet) 0.25 percent in direction of flow. Provide a drip pan elbow on relief valve outlets if the vent rises to prevent backpressure. Terminate vent minimum 300 mm (12 inches) above the roof or through the wall minimum 2.4 m (8 feet) above grade with down turned elbow.

M. Install piping in a first class manor (plumb, clean, and neat)

N. Provide a 25 mm (1 inch) bypass pipe with globe valve for warm-up on all butterfly valves for steam service.

O. Steam systems shall be warmed-up and brought on-line in a supervised fashion, which shall include monitoring steam generating equipment, safety relief devices, drip assemblies and manual draining of flooded traps and drips. Automatic or unsupervised warm-ups are strictly prohibited.

P. Pressure reducing valves shall be sized and installed with full size straight piping ahead of and after the reducing valve in accordance with details on the drawings and manufacturer's recommendations to ensure quiet and stable operation.

Q. Steam safety relief valves shall be installed so as to impress no distorting stress on the valve at static or discharge conditions. Provide a drip pan elbow on piped discharge piping which rises above the discharge connection. Installation of the relief valve, drip pan elbow, discharge and drain piping (including oversized discharge piping off the drip pan elbow) shall be in accordance with manufacturer's instructions. Pipe discharge piping to a safe location and to the outside where possible. Provide cast iron exhaust heads for discharge above roof.

R. Install strainers ahead of reducing valves, control valves and traps and where elsewhere shown. Strainers in steam supply piping shall be installed horizontally (pocket in the horizontal plane); strainers in steam condensate shall be installed with the pocket downwards. Remove, clean and reinstall the basket in each strainer just prior to Owner occupancy.

S. Steam main drip assemblies, each complete with full main size dirt leg, trap, strainer and valves, shall be provided where shown and at each low point in the steam piping if not otherwise shown. All shall be 0.75 inch size.

T. Steam traps shall be installed at least 14 inches below steam heating devices to ensure adequate draining of the coils. Valves, strainers and unions or flanges shall be provided upstream of traps.

U. Automatic pump traps shall be installed in strict accordance with the manufacturer’s instructions. The manufacturers rep shall inspect the installation prior to start-up to verify that the system is installed and piped correctly for the application. Trap exhaust vents shall be terminated outdoors. Horizontal discharges shall be cut-off as 45 degrees and covered with stainless steel birdscreening.

3.2 WELDING

A. The contractor is entirely responsible for the quality of the welding and shall:

1. Conduct tests of the welding procedures used on the project, verify the suitability of the procedures used, verify that the welds made will meet the required tests, and also verify that the welding operators have the ability to make sound welds under standard conditions.
2. Perform all welding operations required for construction and installation of the piping systems.

B. Qualification of Welders: Rules of procedure for qualification of all welders and general requirements for fusion welding shall conform with the applicable portions of ASME B31.1, AWS B2.1/B2.1M, AWS Z49.1, and also as outlined below.

C. Examining Welder: Examine each welder at job site, in the presence of the COR, to determine the ability of the welder to meet the qualifications required. Test welders for piping for all positions, including welds with the axis horizontal (not rolled) and with the axis vertical. Each welder shall be allowed to weld only in the position in which he has qualified and shall be required to identify his welds with his specific code marking signifying his name and number assigned.

D. Examination Results: Provide the COR with a list of names and corresponding code markings. Retest welders who fail to meet the prescribed welding qualifications. Disqualify welders, who fail the second test, for work on the project.

E. Beveling: Field bevels and shop bevels shall be done by mechanical means or by flame cutting. Where beveling is done by flame cutting, surfaces shall be thoroughly cleaned of scale and oxidation just prior to welding. Conform to specified standards.

F. Alignment: Provide approved welding method for joints on all pipes greater than 50 mm (2 inches) to assure proper alignment, complete weld penetration, and prevention of weld spatter reaching the interior of the pipe.

G. Erection: Piping shall not be split, bent, flattened, or otherwise damaged before, during, or after installation. If the pipe temperature falls to 0 degrees C (32 degrees F) or lower, the pipe shall be heated to approximately 38 degrees C (100 degrees F) for a distance of 300 mm (1 foot) on each side of the weld before welding, and the weld shall be finished before the pipe cools to 0 degrees C (32 degrees F).

H. Non-Destructive Examination of Piping Welds:

1. Perform radiographic examination of 50 percent of the first 10 welds made and 10 percent of all additional welds made. The COR reserves the right to identify individual welds for which the radiographic examination must be performed. All welds will be visually inspected by the COR. The VA reserves the right to require testing on additional welds up to 100 percent if more than 25 percent of the examined welds fail the inspection.
2. An approved independent testing firm regularly engaged in radiographic testing shall perform the radiographic examination of pipe joint welds. All radiographs shall be reviewed and interpreted by an ASNT Certified Level III radiographer, employed by the testing firm, who shall sign the reading report.

3. Comply with ASME B31.1. Furnish a set of films showing each weld inspected, a reading report evaluating the quality of each weld, and a location plan showing the physical location where each weld is to be found in the completed project. The COR shall be given a copy of all reports to be maintained as part of the project records and shall review all inspection records.

I. Defective Welds: Replace and reinspect defective welds. Repairing defective welds by adding weld material over the defect or by peening are prohibited. Welders responsible for defective welds must be requalified prior to resuming work on the project.

J. Electrodes: Electrodes shall be stored in a dry heated area, and be kept free of moisture and dampness during the fabrication operations. Discard electrodes that have lost part of their coating.

3.3 PIPE JOINTS

A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1/B2.1M. See Welder's qualification requirements under "Quality Assurance" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Screwed: Threads shall conform to ASME B1.20.1; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

C. 125 Pound Cast Steel Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast steel flange.

3.4 STEAM TRAP PIPING

A. Install to permit gravity flow to the trap. Provide gravity flow (avoid lifting condensate) from the trap where modulating control valves are used. Support traps weighing over 11 kg (24 pounds) independently of connecting piping.

1. On pipe size 1.5 inch and above a raised face flange is required to allow for removal of the steam trap without disturbing surrounding piping.
2. On pipe size below 1.5 inch raised face flanges or unions may be used to allow for removal of the traps.

3.5 LEAK TESTING

A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the COR in accordance with the specified requirements. Testing shall be performed in accordance with the specification requirements.

B. An operating test at design pressure, and for hot systems, design maximum temperature.

C. A hydrostatic test at 1.5 times design pressure for the new piping systems. Valve off existing piping systems as necessary. Factory tested equipment (convertors, exchangers, coils) need not be field tested. Avoid excessive pressure on mechanical seals and safety devices.

D. Prepare and submit test and inspection reports to the COR within 5 working days of test completion and prior to covering the pipe.

3.6 FLUSHING AND CLEANING PIPING SYSTEMS

A. Steam, Condensate and Vent Piping: The piping system shall be flushed clean prior to equipment connection. Cleaning includes pulling all strainer screens and cleaning all scale/dirt legs during startup operation. Contractor shall be responsible for damage caused by inadequately cleaned/flushed systems.

3.7 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. Verify that the piping system has been flushed, cleaned and filled.

D. Lubricate pumps before startup.

E. Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.

F. Verify that correct size heaters-motor over-load devices are installed for each pump controller unit.

G. Field modifications to the bearings and or impeller (including trimming) are prohibited. If the pump does not meet the specified vibration tolerance send the pump back to the manufacturer for a replacement pump. All modifications to the pump shall be performed at the factory.

H. Adjust red set hand on pressure gauges to normal working pressure.

3.8 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4hours to instruct each VA personnel responsible in operation and maintenance of the system.

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SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. This section specifies cleaning and treatment of circulating HVAC water systems, including the following.

1. Cleaning compounds.
2. Chemical treatment for closed loop heat transfer systems.

C. Provide a complete water treatment system for the new hot and chilled water systems as specified herein and shown on the drawings.

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.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

H. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

I. Section 23 21 13, HYDRONIC PIPING.

J. Section 23 22 13, STEAM and CONDENSATE HEATING PIPING.

1.3 APPLICABLE PUBLICATIONS

A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. American Society of Mechanical Engineers (ASME):
ASME Boiler and Pressure Vessel Code (BPVC):
BPVC Section VIII-2021 ..... Rules for Construction of Pressure Vessels, Division 1

C. American Society for Testing and Materials (ASTM):
A666-2015 ..... Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
F441/F441M-2020 ..... Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

D. National Fire Protection Association (NFPA):
70-2020 ..... National Electric Code (NEC)

E. Department of Veterans Affairs (VA):
ES-2019-01..... Cooling Tower Water Systems Policy

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 25 00, HVAC WATER TREATMENT”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Cleaning compounds and recommended procedures for their use.
2. Chemical treatment for closed systems, including installation and operating instructions.

D. Water analysis verification.

E. Materials Safety Data Sheet for all proposed chemical compounds, based on U.S. Department of Labor Form No. L5B-005-4.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Refer to paragraph QUALITY ASSURANCE in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Technical Services: Provide the services of an experienced water treatment chemical engineer or technical representative to direct flushing, cleaning, pre-treatment, training, debugging, and acceptance testing operations; direct and perform chemical limit control during construction period and monitor systems for a period of 12 months after acceptance, including not less than 6 service calls and written status reports. Emergency calls are not included.

C. Chemicals: Chemicals shall be non-toxic approved by local authorities and meeting applicable EPA requirements.

F. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specification section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

G. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 CLEANING COMPOUNDS

A. Alkaline phosphate or non-phosphate detergent/surfactant/specific to remove organic soil, hydrocarbons, flux, pipe mill varnish, pipe compounds, iron oxide, and like deleterious substances, with or without inhibitor, suitable for system wetted metals without deleterious effects.

B. All chemicals shall be acceptable for discharge to sanitary sewer.

C. Refer to Section 23 21 13, HYDRONIC PIPING and Section 23 22 13, STEAM and CONDENSATE HEATING PIPING, PART 3, for flushing and cleaning procedures.

2.2 CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS

A. Inhibitor: Provide sodium nitrite/borate, molybdate-based inhibitor or other approved compound suitable for make-up quality and make-up rate and which will not cause or enhance bacteria/corrosion problems or mechanical seal failure due to excessive total dissolved solids. Shot feed manually. Maintain inhibitor residual as determined by water treatment laboratory, taking into consideration residual and temperature effect on pump mechanical seals.

B. pH Control: Inhibitor formulation shall include adequate buffer to maintain pH range of 8.0 to 10.5.

C. Performance: Protect various wetted, coupled, materials of construction including ferrous, red and yellow metals. Maintain system essentially free of scale, corrosion, and fouling. Corrosion rate of following metals shall not exceed specified mills per year penetration; ferrous, 0-2; brass, 0-1; copper, 0-1. Inhibitor shall be stable at equipment skin surface temperatures and bulk water temperatures of not less than 121 degrees C (250-degrees F) and 52-degrees C (125-degrees F) respectively. Heat exchanger fouling and capacity reduction shall not exceed that allowed by fouling factor 0.0005.

D. Pot Feeder: Bypass type, complete with necessary shutoff valves, drain and air release valves, and system connections, for introducing chemicals into system, cast-iron or steel tank with funnel or large opening on top for easy chemical addition. Feeders shall be 18.9 L (5 gallon) minimum capacity at 860 kPa (125 psig) minimum working pressure.

E. Side Stream Water Filter for Closed Loop Systems: Stainless-steel housing, and polypropylene filter media with polypropylene or stainless-steel core. Filter media shall be compatible with water treatment chemicals used in the system. Replaceable filter cartridges for sediment removal service with minimum 20 micrometer particulate at 98 percent efficiency for approximately 5 percent of system design flow rate. Filter cartridge shall have a maximum pressure drop of 13.8 kPa (2 psig) at design flow rate when clean, and maximum pressure drop of 172 kPa (25 psig)

when dirty. A constant flow rate valve shall be provided in the piping to the filter. Inlet and outlet pressure gauges shall be provided to monitor filter condition.

2.3 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Delivery and Storage: Deliver all chemicals in manufacturer's sealed shipping containers. Store in designated space and protect from deleterious exposure and hazardous spills.

C. Install equipment furnished by the chemical treatment supplier and charge systems according to the manufacturer's instructions and as directed by the Technical Representative.

D. Refer to Section 23 21 13, HYDRONIC PIPING for chemical treatment piping, installed as follows:

1. Provide a bypass line around water meters and bleed off piping assembly. Provide ball valves to allow for bypassing, isolation, and servicing of components.
2. Provide installation supervision, startup and operating instruction by manufacturer's technical representative.

E. Before adding cleaning chemical to the closed system, all air handling coils and fan coil units shall be isolated by closing the inlet and outlet valves and opening the bypass valves. This is done to prevent dirt and solids from lodging the coils.

F. UV-Irradiation Unit Installation: Install UV-Irradiation units on concrete bases level and plumb. Maintain manufacturer's recommended clearances. Arrange units, so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.

G. Do not valve in or operate system pumps until after system has been cleaned.

H. After chemical cleaning is satisfactorily completed, open the inlet and outlet valves to each coil and close the bypass valves. Also, clean all strainers.

I. Perform tests and report results in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

J. After cleaning is complete, and water pH is acceptable to manufacturer of water treatment chemical, add manufacturer recommended amount of chemicals to systems.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. Coordinate the startup and contractor testing schedules with the COR. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

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SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Ductwork and accessories for HVAC including the following:

1. Supply air, return air, outside air, exhaust, and relief systems.
2. Exhaust duct with HEPA filters for Negative Pressure Isolation Room.

C. Definitions:

1. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
2. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
3. Exposed Duct: Exposed to view in a finished room, exposed to weather.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 07 84 00, FIRESTOPPING.

E. Section 08 90 00, LOUVERS AND VENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

H. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

I. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

J. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

K. Section 23 34 00, HVAC FANS.

L. Section 23 40 00, HVAC AIR CLEANING DEVICES.

M. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.

N. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

O. Section 23 82 16, AIR COILS.

P. Section 28 31 00, FIRE DETECTION AND ALARM.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. American Society of Civil Engineers (ASCE):

7-2016 ..... Minimum Design Loads for Associated Criteria for Buildings and Other Structures

C. American Society for Testing and Materials (ASTM):

A653/A653M-2020 ..... Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

A1011/A1011-2018a ..... 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

B209-2021 ..... 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)

E1-2014(R2020) ..... Standard Specification for ASTM Liquid-in-Glass Thermometers

E77-2014(R2021) ..... Standard Test Method for Inspection and Verification of Thermometers

E84-2021a ..... 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):

006–2020..... HVAC Duct Construction Standards, Metal and Flexible, 4th Edition

016-2012 ..... HVAC Air Duct Leakage Test Manual, 2nd Edition

2016 ..... Fibrous Glass Duct Construction Standards, 7th Edition

F. Underwriters Laboratories, Inc. (UL):

181-2013(R2017)..... Standard for Factory-Made Air Ducts and Air Connectors

555-2006(R2020) ..... Standard for Fire Dampers

555S-2014(R2020)..... Standard for Smoke Dampers

G. Department of Veterans Affairs (VA):

PG-18-10-2020(R2022)..... Physical Security Design Manual for VA Mission Critical Facilities

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 23 31 00, HVAC DUCTS AND CASINGS”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Rectangular Ducts:
   a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gauge and reinforcement.
   b. Duct liner.
   c. Sealants and gaskets.
   d. Access doors.
2. Round and Flat Oval Ducts:
   a. Manufacturer's details for duct fittings.
   b. Sealants and gaskets.
   c. Access sections.
   d. Installation instructions.
3. Volume dampers, back draft dampers.
4. Upper hanger attachments.
5. Fire dampers, fire doors, and smoke dampers with installation instructions.
6. Sound attenuators, including pressure drop and acoustic performance.
7. Flexible ducts and clamps, with manufacturer's installation instructions.
8. Flexible connections.
9. Instrument test fittings.
10. Details and design analysis of alternate or optional duct systems.

D. Coordination Drawings: Refer to paragraph SUBMITTALS in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

C. Fire Safety Code: Comply with NFPA 90A.

D. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.

E. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown in the contract documents.

F. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as he duct or provide at least the same level of corrosion resistance.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 DUCT MATERIALS AND SEALANTS

A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A653/A653M, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.

B. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1. Sealant: Low odor elastomeric compound, gun or brush grade, maximum 25 flame spread, and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally, provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are prohibited because they do not retain elasticity and bond.
2. Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.
3. Gaskets in Flanged Joints: Soft neoprene.

C. 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: As scheduled on the drawings.

C. Seal Class: All ductwork shall receive Class A Seal.

D. Duct for Negative Pressure Up to 750 Pa (3 inch WG): Provide for exhaust duct between HEPA filters and exhaust fan inlet including systems for Autopsy Suite exhaust.

1. Round Duct: Galvanized steel, spiral lock seam construction with standard slip joints.
2. Rectangular Duct: Galvanized steel, minimum 1.0 mm (20 gauge), Pittsburgh lock seam, companion angle joints 32 mm by 3.2 mm (1-1/4 by 1/8 inch) minimum at no greater than 2.4 m (8 feet) spacing. Approved pre-manufactured joints are acceptable in lieu of companion angles.

E. Round and Flat Oval Ducts: Furnish duct and fittings made by the same manufacturer to ensure good fit of slip joints. When submitted and approved in advance, round and flat oval duct, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct design shown in the contract documents.

1. Elbows: Diameters 75 through 203 mm (3 through 8 inches) shall be two sections die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
2. Provide bell mouth, conical tees or taps, laterals, reducers, and other low loss fittings as shown in SMACNA HVAC Duct Construction Standards, Metal and Flexible.
3. Ribbed Duct Option: Lighter gauge round/oval duct and fittings may be furnished provided certified tests indicating that the rigidity and performance is equivalent to SMACNA standard gauge ducts are submitted.
   a. Ducts: Manufacturer's published standard gauge, G90 coating, spiral lock seam construction with an intermediate standing rib.
   b. Fittings: May be manufacturer's standard as shown in published catalogs, fabricated by spot welding and bonding with neoprene base cement or machine formed seam in lieu of continuous welded seams.
4. Provide flat side reinforcement of oval ducts as recommended by the manufacturer and SMACNA HVAC Duct Construction Standards, Metal and Flexble. Because of high pressure loss, do not use internal tie-rod reinforcement.

F. Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 508 mm (20 inches) wide by 1219 to 1372 mm (48 to 54 inches) high. Provide view port in the doors.

Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

G. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards. Refer to SMACNA for Single Blade and Multi-blade Volume Dampers.

H. Duct Hangers and Supports: Refer to SMACNA Standards. Avoid use of trapeze hangers for round duct.

2.3 DUCT LINER (WHERE INDICATED IN THE CONTRACT DOCUMENTS)

A. Duct sizes shown in the contract documents for lined duct are clear opening inside lining.

B. Duct liner is only permitted to be used for return, relief and general exhaust ducts. Duct liner is prohibited for outside air ducts, supply air ducts or any other positive pressure ductwork (provide exterior insulation only).

C. Rectangular Duct or Casing Liner: ASTM C1071, Type I (flexible), or Type II (board), 25 mm (1 inch) minimum thickness, applied with mechanical fasteners and 100 percent coverage of adhesive in conformance with SMACNA.

2.4 DUCT ACCESS DOORS, PANELS AND SECTIONS

A. Provide access doors, sized and located for maintenance work, upstream, in the following locations:

1. Each fire damper (for link service), smoke damper and automatic control damper.
2. Each duct mounted smoke detector.

B. Openings shall be as large as feasible in small ducts, 305 mm by 305 mm (12 inch by 12 inch) minimum where possible. Access sections in insulated ducts shall be double-wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.

1. For Rectangular Ducts: Refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible.
2. For Round and Flat Oval Ducts: Refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible.

2.5 FIRE DAMPERS

A. Galvanized steel, interlocking blade type, UL listing and label, 1-1/2-hour rating, 70 degrees C (158 degrees F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

B. Fire dampers in wet air exhaust shall be of stainless-steel construction, all others may be galvanized steel.

C. Minimum Requirements for Fire Dampers:

1. The damper frame may be of design and length as to function as the mounting sleeve, thus eliminating the need for a separate sleeve, as allowed by UL 555. Otherwise provide sleeves and mounting angles, minimum 1.9 mm (14 gauge), required to provide installation equivalent to the damper manufacturer's UL test installation.

2. Submit manufacturer's installation instructions conforming to UL rating test.

2.6 SMOKE DAMPERS

A. Maximum air velocity, through free area of open damper, and pressure loss: Low pressure and medium pressure duct (supply, return, exhaust, outside air): 457 m/min (1500 fpm). Maximum static pressure loss: 32 Pa (0.13 inch WG).

B. Leakage: Class I.

C. Maximum Air Leakage, Closed Damper: 8.0 cfm per square foot at 4 inch WG differential pressure.

D. Minimum Requirements for Dampers:

1. Shall comply with requirements of UL 555S, except for the Fire Endurance and Hose Stream Test.
2. Frame: Galvanized steel channel with side, top and bottom stops or seals.
3. Blades: Galvanized steel, parallel type preferably, 305 mm (12 inch) maximum width, edges sealed with neoprene, rubber or felt, if required to meet minimum leakage. Airfoil (streamlined) type for minimum noise generation and pressure drop are preferred for duct mounted dampers.
4. Shafts: Galvanized steel.
5. Bearings: Nylon, bronze sleeve or ball type.
6. Hardware: Zinc plated.
7. Operation: Automatic open/close. No smoke damper that requires manual reset or link replacement after actuation is acceptable. See contract documents for required control operation.

E. Motor Operator (Actuator): Provide electric as required by the automatic control system, externally mounted on stand-offs to allow complete insulation coverage.

2.7 FLEXIBLE AIR DUCT

A. General: Factory-fabricated, complying with NFPA 90A for connectors not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier which is required to have a fire resistance rating of one hour or more. Flexible duct length shall not exceed 1.5 m (5 feet). Provide insulated acoustical air duct connectors in supply air duct systems and elsewhere as shown.

B. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts greater than 203 mm (8 inches) in diameter shall be Class 1. Ducts less than 203 mm (8 inches) in diameter shall be Class 1 or Class 2.

C. Insulated Flexible Air Duct: Factory-fabricated including mineral fiber insulation with maximum C factor of 0.25 at 24 degrees C (75 degrees F) mean temperature, encased with a low permeability moisture barrier outer jacket, having a puncture resistance of not less than 50 Beach Units.

Acoustic insertion loss shall not be less than 3 dB per 300 mm (foot) of straight duct, at 500 Hz, based on 152 mm (6 inch) duct, of 762 m/min (2500 fpm).

D. Application Criteria:
   1. Temperature Range: -18 to 93 degrees C (0 to 200 degrees F) internal.
   2. Maximum Working Velocity: 1219 m/min (4000 fpm).
   3. Minimum Working Pressure, Inches of Water Gauge: 2500 Pa (10 inches WG) positive, 500 Pa (2 inches WG) negative.

E. Duct Clamps: 100 percent nylon strap, 80 kg (176 pounds) minimum loop tensile strength manufactured for this purpose or stainless-steel strap with cadmium plated worm gear tightening device. Apply clamps with sealant and as approved for UL 181, Class 1 installation.

F. Flexible air duct is prohibited in operating room suites, SPS processing spaces, Pharmacy compounding spaces, Protective Environment spaces, Isolation Rooms, Clean Rooms, Bio-containment Laboratories, Research Laboratories, and Clinical Laboratories.

2.8 FLEXIBLE DUCT CONNECTIONS

A. Where duct connections are made to fans, and air handling units, install a non-combustible flexible connection of 822 g (29 ounces) neoprene coated fiberglass fabric approximately 152 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless-steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to ensure that no vibration is transmitted.

2.9 SOUND ATTENUATING UNITS

A. Casing, not less than 1.0 mm (20 gauge) galvanized sheet steel, or 1.3 mm (18 gauge) aluminum fitted with suitable flanges to make clean airtight connections to ductwork. Sound-absorbent material faced with glass fiber cloth and covered with not less than 0.6 mm (24 gauge) or heavier galvanized perforated sheet steel, or 0.85 mm (22 gauge) or heavier perforated aluminum. Perforations shall not exceed 4 mm (5/32 inch) diameter, approximately 25 percent free area. Sound absorbent material shall be long glass fiber acoustic blanket meeting requirements of NFPA 90A.

B. Entire unit shall be completely air tight and free of vibration and buckling at internal static pressures up to 2000 Pa (8 inches WG) at operating velocities.

C. Pressure drop through each unit: Not to exceed indicated value at design air quantities indicated.

D. Submit complete independent laboratory test data showing pressure drop and acoustical performance.

E. Cap open ends of attenuators at factory with plastic, heavy duty paper, cardboard, or other appropriate material to prevent entrance of dirt, water, or any other foreign matter to inside of attenuator. Caps shall not be removed until attenuator is installed in duct system.

2.10 FIRESTOPPING MATERIAL

A. Refer to Section 07 84 00, FIRESTOPPING.

2.11 DUCT MOUNTED THERMOMETER (AIR)

A. Stem Type Thermometers: ASTM E1, 7 inch scale, red(organic) liquid filled, lens front tube, cast aluminum case with enamel finish and clear glass or polycarbonate window, brass stem, 2 percent of scale accuracy to ASTM E77 scale calibrated in degrees Fahrenheit.

B. Thermometer Supports:

1. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
2. Flange: 75 mm (3 inch) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.12 DUCT MOUNTED TEMPERATURE SENSOR (AIR)

A. Refer to Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

2.13 INSTRUMENT TEST FITTINGS

A. Manufactured type with a minimum 50 mm (2 inch) length for insulated duct, and a minimum 25 mm (1 inch) length for duct not insulated. Test hole shall have a flat gasket for rectangular ducts and a concave gasket for round ducts at the base, and a screw cap to prevent air leakage.

B. Provide instrument test holes at each duct or casing mounted temperature sensor or transmitter, and where otherwise indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.

C. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:

1. Contract documents show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the Government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes in the contract documents are inside

dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.

2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards.
4. Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.

D. Install duct hangers and supports in accordance with SMACNA Standards.

E. Install fire dampers and smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install fire dampers and smoke dampers at locations indicated and where ducts penetrate fire rated and/or smoke rated walls, shafts and where required by the COR. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges per UL and NFPA. Demonstrate resetting of fire dampers and operation of smoke dampers to the COR.

F. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.

G. Flexible Duct Installation: Refer to flexible duct connection detail on drawings, as well as SMACNA Standards. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long per NFPA 90A, as straight and short as feasible, adequately supported. Centerline radius of bends shall be not less than two duct diameters. Make connections with clamps as recommended by SMACNA. Clamp per SMACNA with one clamp on the core duct and one on the insulation jacket. Flexible ducts shall not penetrate floors, or any chase or partition designated as a fire or smoke barrier, including corridor partitions fire rated one hour or two hours. Support ducts per SMACNA Standards.

H. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.

I. Control Damper Installation:

1. Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.
2. Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.

3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.
4. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.

J. Air Flow Measuring Devices: Install units with minimum straight run distances, upstream and downstream as recommended by the manufacturer.

K. Low Pressure Duct Liner: Install in accordance with SMACNA Standards.

L. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition or return to source of supply for repair or replacement, as determined by COR. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

3.2 DUCT LEAKAGE TESTS AND REPAIR

A. Ductwork leakage testing shall be performed by the Testing and Balancing Contractor directly contracted by the General Contractor and independent of the Sheet Metal Contractor.

B. Ductwork leakage testing shall be performed for the entire air distribution system (including all supply, return, exhaust and relief ductwork), section by section, including fans, coils and filter sections.

C. Test procedure, apparatus and report shall conform to SMACNA HVAC Air Duck Leakage Test Manual. The maximum leakage rate allowed is 4 percent of the design air flow rate.

D. All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.

E. All tests shall be performed in the presence of the COR and the Test and Balance agency. The Test and Balance agency shall measure and record duct leakage and deliver report to the COR and identify leakage source with excessive leakage.

F. If any portion of the duct system tested fails to meet the permissible leakage level, the Contractor shall rectify sealing of ductwork to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the COR.

G. All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.

H. Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.

3.3 TESTING, ADJUSTING, AND BALANCING (TAB)

A. Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

3.4 OPERATING AND PERFORMANCE TESTS

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

- - - E N D - - -

SECTION 23 34 00
HVAC FANS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Fans for heating, ventilating and air conditioning.

C. Product Definitions: AMCA 99.

D. Fans shall be constructed, rated and labeled in accordance with AMCA Standard 210 67. Fans shall be statically and dynamically balanced throughout the operating range. The class of the fan provided shall be adequate for the duty specified plus a 25 percent increase in static pressure. Shop drawing submittals shall state maximum fan RPM for fan class provided. No infringement will be allowed on this requirement. Submittals shall include fan curves showing operating point(s), system curves, and surge lines.

E. Fans with Electronically Commutated Motors (ECM's) shall be selected such that the maximum available motor RPM shall at minimum accommodate 10% additional fan CFM at a 21% increase in fan static pressure, over what is specified as the duty point. This elevated performance point shall also not exceed the motor's Hp limitations or the fan's construction class. Shop drawing information shall reflect these requirements. Motor speeds shall be adjustable in the field, and any hard programmed limitations of motor speed or fan performance shall be based on the required elevated performance stated above.

F. Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressure determined in accordance with the building and mechanical code.

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 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.

F. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

G. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

H. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

I. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.

J. Section 23 82 16, AIR COILS.

K. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. Air Movement and Control Association International, Inc. (AMCA):

99-2016 ..... Standards Handbook

210-2016 ..... Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

300-2014 ..... Reverberant Room Method for Sound Testing of Fans

C. American Society for Testing and Materials (ASTM):

B117-2019 ..... Standard Practice for Operating Salt Spray (Fog) Apparatus

D1735-2014 ..... Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus

D3359-2017 ..... Standard Test Methods for Rating Adhesion by Tape Test

G152-2013(R2021) ..... Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of NonMetallic Materials

G153-2013(R2021) ..... Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of NonMetallic Materials

D. National Fire Protection Association (NFPA):

NFPA 96-2021 ..... Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

E. National Sanitation Foundation (NSF):

37-2020 ..... Air Curtains for Entranceways in Food and Food Service Establishments

F. Underwriters Laboratories, Inc. (UL):

181-2013 ..... Standard for Factory-Made Air Ducts and Air Connectors

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 34 00, HVAC FANS”, with applicable paragraph identification.

C. Manufacturers Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Plenum fan, motors, and drives.
2. Centrifugal fans, motors, drives, accessories, and coatings.

a. Inline centrifugal fans.

3. Centrifugal ceiling fans.
4. Propeller fans.

D. Certified sound power levels for each fan.

E. Motor ratings, types, electrical characteristics, and accessories.

F. Certified fan performance curves for each fan showing cubic feet per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation.

G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Fans and power ventilators shall bear the AMCA performance seal.

B. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).

C. Fans and power ventilators shall comply with the following standards:

1. Testing and Rating: AMCA 210.
2. Sound Rating: AMCA 300.

D. Vibration Tolerance for Fans and Power Ventilators: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

E. Performance Criteria:

1. The fan schedule shall show the design air volume and static pressure. Select the fan motor hp by increasing the fan bhp by 10 percent to account for the drive losses and field conditions.
2. Select the fan operating point as follows:

a. Forward Curve and Axial Flow Fans: Right hand side of peak pressure point.
b. Air Foil, Backward Inclined, or Tubular: At or near the peak static efficiency.

F. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge where exposed to operating and maintenance personnel.

G. Corrosion Protection:

1. Except for fans in fume hood exhaust service, all steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturer’s paint and paint system shall meet the minimum requirements of ASTM D1735 water fog, ASTM B117 salt spray, ASTM D3359 adhesion, and ASTM G152 and ASTM G153 for carbon arc light apparatus for exposure of non-metallic material.

2. Fans for general purpose fume hoods, or chemical hoods, and radioisotope hoods shall be constructed of materials compatible with the chemicals being transported in the air through the fan.

H. Spark resistant construction: If flammable gas, vapor or combustible dust is present in concentrations above 20 percent of the Lower Explosive Limit (LEL), the fan construction shall be as recommended by AMCA's Classification for Spark Resistant Construction. Drive set shall be comprised of non-static belts for use in an explosive.

I. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

J. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.7 EXTRA MATERIALS

A. Provide one additional set of belts for all belt-driven fans.

PART 2 - PRODUCTS

2.1 PLENUM FAN

A. Plenum Fans – Single and/or Multiple Fans in an Array:

1. General: Fans shall be Class II (minimum) construction with single inlet, aluminum wheel and stamped air-foil aluminum bladed. The fan wheel shall be mounted on the directly-driven motor shaft in AMCA Arrangement 4. Fans shall be dynamically balanced and internally isolated to minimize the vibrations. Provide a steel inlet cone for each wheel to match with the fan inlet. Locate fan in the air stream to assure proper flow. The fan performance shall be rated in accordance with AMCA 210 or ASHRAE 51.

2. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. Following fan assembly, the complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor

bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).

3. The plenum fans shall be driven by variable speed drives with at least one back-up drive as shown in the design documents. Use of a drive with bypass is not permitted.
4. Multiple fans shall be installed in a pre-engineered structural frame to facilitate fan stacking. All fans shall modulate in unison, above or below the synchronous speed within the limits specified by the manufacturer, by a common control sequence. Staging of the fans is not permitted. Redundancy requirement shall be met by all operating fans in an array and without the provision of an idle standby fan.
5. Fan Accessories
   a. Fan Isolation: Provide an actuator-controlled damper to isolate the fan not in operation due to failure.
   b. Fan Airflow Measurement: Provide an airflow measuring device integral to the fan to measure air volume within +/- 5 percent accuracy. The probing device shall not be placed in the airflow path to stay clear of turbulence and avoid loss of performance.

2.2 CENTRIFUGAL FANS

A. Record factory vibration test results on the fan or furnish to the Contractor.
B. Fan arrangement, unless noted or approved otherwise:
   1. DWDI fans: Arrangement 3.
   2. SWSI fans: Arrangement 1, 3, 9 or 10.
C. Construction: Wheel diameters and outlet areas shall be in accordance with AMCA standards.
   1. Housing: Low carbon steel, arc welded throughout, braced and supported by structural channel or angle iron to prevent vibration or pulsation, flanged outlet, inlet fully streamlined. Provide lifting clips, and casing drain. Provide manufacturer's standard access door. Provide 13 mm (1/2 inches) wire mesh screens for fan inlets without duct connections.
   2. Wheel: Steel plate with die formed blades welded or riveted in place, factory balanced statically and dynamically.
   3. Shaft: Designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fans class.
   4. Bearings: Heavy duty ball or roller type sized to produce a B10 life of not less than 50,000 hours, and an average fatigue life of 200,000 hours. Extend filled lubrication tubes for interior bearings or ducted units to outside of housing.
   5. Belts: Oil resistant, non-sparking and non-static.
   6. Belt Drives: Factory installed with final alignment belt adjustment made after installation.
   7. Motors and Fan Wheel Pulleys: Adjustable pitch for use with motors through 15 hp, fixed pitch for use with motors greater than 15 hp. Select pulleys so that pitch adjustment is at the middle of the adjustment range at fan design conditions.

8. Motor, adjustable motor base, drive and guard: Furnish from factory with fan. Provide protective sheet metal enclosure for fans located outdoors. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC for specifications.
9. Furnish variable speed fan motor controllers where shown in the contract documents. Refer to Section 26 29 11, MOTOR CONTROLLERS. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC for controller/motor combination requirements.

D. Inline Centrifugal Fans: Provide minimum 18 Gauge galvanized steel housing with inlet and outlet flanges, backward inclined aluminum centrifugal fan wheel, bolted access door and supports as required. Motors shall be factory pre-wired to an external junction box. Provide factory wired disconnect switch.

2.3 CENTRIFUGAL CEILING FANS

A. Steel housing, baked enamel finish, direct connected fan assembly, attached grille. Provide gravity back draft assembly, aluminum wall cap and bird or insect screen. Provide electric motor operated damper unless indicated otherwise on drawings.
B. Acoustical Lining: 13 mm (1/2 inch) thick mineral fiber, dark finish. Comply with UL 181 for erosion.
C. Motor: Shaded pole or permanent split capacitor, sleeve bearings, supported by steel brackets in combination with rubber isolators.
D. Ceiling Grille, (Where indicated): White plastic manufacturer’s standard design, 80 percent free area.
E. Control: Provide solid state speed control (located at unit) for final air balancing.

2.4 PROPELLER FANS

A. Belt-driven or direct-driven fans as indicated in the contract documents.
B. Square steel panel, deep drawn venturi, arc welded to support arms and fan/motor support brackets, baked enamel finish. Provide wall collar for thru-wall installations.
C. Motor, Motor Base and Drive: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Motor shall be totally enclosed type.
D. Wall Shutter: Fan manufacturer's standard, steel frame, aluminum blades, heavy duty stall type electric damper motor, spring closed.
E. Wire Safety Guards: Provide on exposed inlet and outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.
B. Install fan, motor and drive in accordance with manufacturer's instructions.
C. Align fan and motor sheaves to allow belts to run true and straight.
D. Bolt equipment to curbs with galvanized lag bolts.

E. Install vibration control devices as shown in the contract documents and specified in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

F. Arrange installation of fans to provide access space around fans for service and maintenance.

G. Adjust damper linkages for proper damper operation. Motorized backdraft dampers shall be wired to open when the fan operates. Coordinate with Division 26.

H. Fans with E.C. Motors shall be commissioned and set-up by a factory authorized technician to meet project requirements, and interface coordinated with the B.A.S.

3.2 PRE-OPERATION MAINTENANCE

A. Lubricate bearings, pulleys, belts and other moving parts with manufacturer recommended lubricants.

B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.

C. Clean fan interiors to remove foreign material and construction dirt and dust.

3.3 STARTUP AND TESTING

A. Verify operation of motor, drive system and fan wheel according to the contract documents.

B. Check vibration and correct as necessary for air balance work.

C. After air balancing is complete and permanent sheaves are in place perform necessary field mechanical balancing to meet vibration tolerance in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

D. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

E. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

F. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 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.

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SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air Outlets and Inlets: Diffusers, registers, and grilles.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 08 90 00, LOUVERS and VENTS.

E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

F. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

G. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. Air Duct Council:
Flexible Duct Performance & Installation Standards (Manual), 5th Edition Green Book

C. American Society of Civil Engineers (ASCE):
7-2016 ..... Minimum Design Loads and Associated Criteria for Buildings and Other Structures

D. American Society for Testing and Materials (ASTM):
B209/B209M-2021 ..... Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

E. National Fire Protection Association (NFPA):
90A-2021 ..... Standard for the Installation of Air-Conditioning and Ventilating Systems

F. Underwriters Laboratories, Inc. (UL):
181-2013(R2017)..... Standard for Factory-Made Air Ducts and Air Connectors

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Diffusers, registers, grilles, and accessories.

D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Fire Safety Code: Comply with NFPA 90A.

B. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

C. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 AIR OUTLETS AND INLETS

A. Materials:

1. Steel or aluminum as indicated on drawings except that all supply air outlets installed in operating rooms and Cystoscopy rooms shall be stainless-steel (see paragraph Operating Room Air Distribution Devices in this section). 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 shall be stainless-steel.
3. Contractor shall review all ceiling drawings and details and provide all ceiling mounted devices with appropriate dimensions and trim for the specific locations.

B. Performance Test Data: In accordance with Air Duct Council “Flexible Duct Performance & Installation Standards (Manual), Green Book”. Refer to Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT for NC criteria.

C. Air Supply Outlets:

1. Ceiling Diffusers: Suitable for surface mounting, exposed T-bar or special tile ceilings, off-white finish, square or round neck connection as shown on the contract drawings. Provide factory installed molded mineral fiber insulation blanket with foil backing on body of ceiling diffusers, minimum R value of 4.2. Provide plaster frame for units in plaster ceilings.
   a. Square plaque or multiple cone face, Fixed Pattern: Round neck, T-Bar or surface mounting as indicated on drawings.
   b. Louver Face Type: Square or rectangular, with removable core for 1, 2, 3, or 4 way directional pattern.
   c. 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. Aerodynamically curved blades shall be able to be set for left, right, or vertical discharge airflow pattern before or after installation.
      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 the contract 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 WG).
      5) Diffusers shall have 2-1” slots unless indicated otherwise on drawings.
2. Supply Registers: Double deflection type with horizontal face bars and opposed blade damper with removable key operator.
   a. Margin: Flat, 32 mm (1-1/4 inches) wide.
   b. Bar Spacing: 19 mm (3/4 inch).
   c. Finish: Off white baked enamelunless indicated otherwise on drawings.
4. Supply Grilles: Same as registers but without the opposed blade damper.

D. Return and Exhaust Registers and Grilles: Provide opposed blade damper with removable key operator for registers.

1. Finish: Off-white baked enamelunless indicated otherwise on drawings.
2. Standard Wall Type: Fixed horizontal face bars set at 30 to 45 degrees, 3/4 inch blade spacing, approximately 32 mm (1-1/4 inch) margin.

3. Linear Type: To match supply units.
4. Door Grilles: Are furnished with the doors.
5. Egg Crate Grilles: Aluminum or Painted Steel 13 mm by 13 mm by 13 mm (1/2 inch by 1/2 inch by 1/2) inch grid providing 90 percent free area.
   a. Heavy extruded aluminum frame shall have countersunk screw mounting. Unless otherwise indicated, register blades and frame shall have factory applied white finish.
   b. Grille shall be suitable for duct or surface mounting as indicated on the contract drawings. All necessary appurtenances shall be provided to allow for mounting.

2.2 WIRE MESH GRILLE

A. Fabricate grille with 2 by 2 inch mesh 13 mm (1/2 inch) galvanized steel or aluminum hardware cloth in a spot welded galvanized steel frame with approximately 38 mm (1-1/2 inch) margin.
B. Use grilles where shown in unfinished areas such as mechanical rooms.

2.3 FILTER RETURN/EXHAUST GRILLE

A. Provide grille within stream 25 mm (1 inch) deep MERV 4 filter and removable face.
   1. Finish: Off-white baked enamel unless indicated otherwise on drawings.
   2. Standard Type: Fixed horizontal face bars set at 30 to 45 degrees, 3/4 inch blade spacing, approximately 32 mm (1-1/4 inch) margin.
   3. Steel, aluminum, or stainless-steel as scheduled.
   4. Standard face connected to a mounting frame with space for a throwaway filter. Hold face closed by a locking screw. Provide retaining clips to hold filter in place. Provide fiberglass throwaway filter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.
B. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.
C. Protection and Cleaning: Protect equipment and materials against physical damage. Place equipment in first class operating condition or return to source of supply for repair or replacement, as determined by COR. Protect equipment during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting.
D. Verify & ensure compatibility of ceiling mounted devices with the ceilings and suspension systems (lay in, concealed spline, plaster, drywall). Verify with the architectural drawings and prime contractor.
E. Carefully align square and rectangular devices with the vertical and horizontal building lines. Diffusers shall be attached rigidly to the ductwork. Where connected by flexible ducts, special

supports shall be provided as required, either from the ceiling suspension system or by independent suspension wires or rods from the building structure. See drawings for details.

3.2 INTAKE/EXHAUST HOODS 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 as indicated in Section 23 05 11.

3.3 TESTING, ADJUSTING, AND BALANCING (TAB)

A. Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

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.

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SECTION 23 40 00
HVAC AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air filters, housings and framework shall be provided as shown on the drawings and as specified herein. Refer to the drawings for air filter types, service and mounting.

C. Air filters specified in air handling equipment sections shall conform to requirements of this Specification Section and shall be furnished with that equipment as accessory items, factory installed.

D. Air filters for heating, ventilating and air conditioning.

E. Definitions: Refer to ASHRAE 52.2 for definitions of face velocity, net effective filtering area, media velocity, initial resistance (pressure drop), MERV (Minimum Efficiency Reporting Value), PSE (Particle Size Efficiency), particle size ranges for each MERV number, dust holding capacity and explanation of electrostatic media based filtration products versus mechanical filtration products. Refer to ASHRAE 52.2 for definition of MERV-A.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

F. Section 23 37 00, AIR OUTLETS AND INLETS.

G. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):

850-2013 ..... Performance Rating of Commercial and Industrial Air Filter Equipment

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):

52.2-2017.....Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size

170-2021 ..... Ventilation of Health Care Facilities

D. American Society of Mechanical Engineers (ASME):
ASME Boiler and Pressure Vessel Code -
BPVC Section IX-2021 ..... Welding, Brazing, and Fusing Qualifications

E. American Welding Society (AWS):
D9.1/D9.1M-2018..... Sheet Metal Welding Code

F. International Organization for Standardization (ISO):
9001-2015(R2021) ..... Quality Management Systems - Requirements

G. Underwriters Laboratories, Inc. (UL):
586-2009(R2017) ..... Standard for High-Efficiency, Particulate, Air Filter Units
900-2015 ..... Standard for Air Filter Units

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Extended surface filters.
   3. Magnehelic gauges.

D. Air Filter performance reports.

E. Suppliers warranty.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Filter Warranty for Extended Surface Filters: Guarantee the filters against leakage, blow-outs, and other deficiencies during their normal useful life, up to the time that the filter reaches the final pressure drop. Defective filters shall be replaced at no additional cost or time to the Government.

B. Comply with UL 900 for flame test.

C. Nameplates: Each filter shall bear a label or name plate indicating manufacturer's name, filter size, rated efficiency, and UL classification.

D. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products

meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

E. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 REPLACEMENT FILTER ELEMENTS TO BE FURNISHED

A. To allow temporary use of HVAC systems for testing and in accordance with Paragraph, TEMPORARY USE OF MECHANICAL AND ELECTRICAL SYSTEMS in Section 01 00 00, GENERAL REQUIREMENTS. Provide one complete set of spare filters to the COR.

B. The COR will direct whether these additional filters will either be installed as replacements for dirty units or turned over to VA for future use as replacements.

2.2 EXTENDED SURFACE AIR FILTERS

A. Use factory assembled air filters of the extended surface type with supported or non-supported cartridges for removal of particulate matter in air conditioning, heating and ventilating systems. Filter units shall be of the extended surface type fabricated for disposal when the contaminant load limit is reached as indicated by maximum (final) pressure drop.

B. Filter Classification: UL listed and approved conforming to UL 900.

C. HVAC Filter Types:

MERV Value ASHRAE 52.2	Application	Particle Size	Thickness /Type
8	Pre-Filter	3 to 10 Microns	50 mm (2 inch) Throwaway
13	(Alternate) After-Filter	0.3 to 1 Microns	152 mm (6 inch) or 305 mm (12 inch) Rigid Cartridge

2.3 MEDIUM EFFICIENCY PLEATED PANEL PRE-FILTERS (200 MM (4 INCH); MERV 8; UL 900 CLASS 2)

A. Construction: Air filters shall be medium efficiency ASHRAE pleated panels consisting of cotton and synthetic or 100 percent virgin synthetic media, self-supporting media with required media stabilizers, and beverage board enclosing frame. Filter media shall be lofted to a uniform depth and formed into a uniform radial pleat. The media stabilizers shall be bonded to the downstream side of the media to maintain radial pleats and prevent media oscillation. An enclosing frame of no less than 28-point high wet-strength beverage board shall provide a rigid and durable enclosure. The frame shall be bonded to the media on all sides to prevent air bypass. Integral

diagonal support members on the air entering and air exiting side shall be bonded to the apex of each pleat to maintain uniform pleat spacing in varying airflows.

B. Performance: The filter shall have a Minimum Efficiency Reporting Value of MERV 8 when evaluated under the guidelines of ASHRAE 52.2. The media shall maintain or increase in efficiency over the life of the filter. All testing is to be conducted on filters with a nominal 610 mm by 610 mm (24 inch by 24 inch) face dimension.

Minimum Efficiency Reporting (MERV)	8
Dust Holding Capacity (Grams)	105
Nominal Size (Inches Width x Height x Depth)	24x24x2
Rated Air Flow Capacity (cfm)	2,000
Rated Air Flow Rate (fpm)	500
Final Resistance (Inches WG) Maximum Recommended Change-Out Resistance (Inches WG)	1.0 0.66
Rated Initial Resistance (Inches WG)	0.25

C. The filters shall be approved and listed by Underwriters Laboratories, Inc. as Class 2 when tested according to UL 900.

2.4 HIGH EFFICIENCY EXTENDED SURFACE (FINAL) CARTRIDGE FILTERS (200 MM (4 INCH); MERV 13; UL 900 CLASS 2)

A. Construction: Air filters shall consist of 8 pleated media packs assembled into 4 V-banks within a totally plastic frame. The filters shall be capable of operating at temperatures up to 80 degrees C (176 degrees F). The molded end panels shall be made of high impact polystyrene plastic. The center support members shall be made of ABS plastic. No metal components shall be used.

B. Media: The media shall be made of micro glass fibers with a water repellent binder. The media shall be a dual density construction, with coarser fibers on the air entering side and finer fibers on the air leaving side. The media shall be pleated using separators made of continuous beads of low profile thermoplastic material. The media packs shall be bonded to the structural support members at all points of contact, this improves the rigidity as well as eliminates potential air bypass in the filter.

C. Performance: Filters of the size, air flow capacity and nominal efficiency (MERV) shall meet the following rated performance specifications based on the ASHRAE 52.2 test method. All testing is to be conducted on filters with a nominal 610 mm by 610 mm (24 inch by 24 inch) header dimension.

Minimum Efficiency Reporting Value (MERV)	13

Gross Media Area (sf) Dust Holding Capacity (Grams)	197 430
Nominal Size (Inches Width x Height x Depth)	24x24x12
Rated Air Flow Capacity (cfm)	2,000
Rated Air Flow Rate (fpm)	500
Final Resistance (Inches WG) Maximum Recommended Change-Out Resistance (Inches WG)	1.0 0.66
Rated Initial Resistance (Inches WG)	0.4

2.7 INSTRUMENTATION

A. Magnehelic Differential Pressure Filter Gauges: Nominal 100 mm (4 inch) diameter, 0 to 500 Pa (0 to 2 inches WG), 3 inch for HEPA range. Gauges shall be flush-mounted in aluminum panel board, complete with static tips, copper or aluminum tubing, and accessory items to provide zero adjustment.

B. DDC Static (Differential) Air Pressure Measuring Station: Refer to control diagrams and sequences on drawings and Section 23 09 23, DIRECT DIGITAL CONTROL SYSTEM FOR HVAC.

C. Provide one DDC sensor across each extended surface filter. Provide Petcocks for each gauge or sensor.

D. Provide one common filter gauge for two-stage filter banks with isolation valves to allow differential pressure measurement.

2.8 HVAC EQUIPMENT FACTORY FILTERS

A. Manufacturer filters within fabricated packaged equipment shall conform to requirements of this Specification Section.

2.9 FILTER RETURN GRILLES

A. Refer to Section 23 37 00, AIR OUTLETS AND INLETS.

PART 3 – EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Install supports, filters, and gauges in accordance with manufacturer's instructions.

C. Label clearly with words "Contaminated Air" on exhaust ducts leading to the HEPA filter housing.

D. Furnish one complete initial set of filters and one complete set of spare filters for each filter bank in the project. This is in addition to filters used for temporary heating.

E. Place spare filter media for storage where directed by the COR.

3.2 STARTUP AND TESTING

A. Clean and vacuum air handling units and plenums prior to starting air handling systems.

B. Replace pre-filters and install clean filter units prior to final inspection as directed by the COR.

C. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

D. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

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SECTION 23 64 00
PACKAGED WATER CHILLERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. This section covers Scroll air-cooled chillers complete with accessories.

1.2 DEFINITIONS

A. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.

B. BACNET: Building Automation Control Network Protocol, ASHRAE 135.

C. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.

D. FTT-10: Echelon Transmitter-Free Topology Transceiver.

1.3 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

E. Section 03 30 53, CAST-IN-PLACE CONCRETE.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.

H. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

I. Section 23 21 13, HYDRONIC PIPING.

J Section 23 21 23, HYDRONIC PUMPS.

K. Section 23 31 00, HVAC DUCTS and CASINGS

L. Section 26 29 11, MOTOR CONTROLLERS.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. Air Conditioning, Heating, and Refrigeration Institute (AHRI):

495-2005(R2009)..... Performance Rating of Refrigerant Liquid Receivers

550/590-2020..... Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle

560-2000 ..... Absorption Water Chilling and Water Heating Packages

575-2017 ..... Method of Measuring Machinery Sound Within an Equipment Space

C. American Bearing Manufacturers Association (ABMA):

9–2015(R2020) ..... Load Ratings and Fatigue Life for Ball Bearings

11-2014(R2020) ..... Load Ratings and Fatigue Life for Roller Bearings

D. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

15-2019 ..... Safety Standard for Refrigeration Systems

34-2022 ..... Designation and Classification of Refrigerants (ANSI)

135-2020 ..... BACnet - A Data Communication Protocol for Building Automation and Control Networks

E. American Society of Mechanical Engineers (ASME):

ASME Boiler and Pressure Vessel Code -

BPVC Section VIII-2021 ..... Rules for Construction of Pressure Vessels, Division 1

F. American Society of Testing Materials (ASTM):

B117-2019 ..... Standard Practice for Operating Salt Spray (Fog) Apparatus

C534/C534M-2020a ..... Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C612-2014(R2019) ..... Standard Specification for Mineral Fiber Block and Board Thermal Insulation

D4587-2011(R2019)e1 ..... Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings

G. Occupational Safety and Health Administration (OSHA):

29 CFR 1910.95 ..... Occupational Noise Exposure

H. Department of Veterans Affairs (VA):

H-18-8-2023 ..... Seismic Design Requirements

PG-18-10-2017(R2023) ..... HVAC Design Manual

1.5 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Scroll water chillers, including motor starters, control panels, and vibration isolators, and remote condenser data shall include the following:

a. Rated capacity.
b. Pressure drop.
c. Efficiency at full load and part load WITHOUT applying any tolerance indicated in the AHRI 550/590.
d. Refrigerant
e. Fan performance (Air-Cooled Chillers only.)
f. Accessories.
g. Installation instructions.
h. Startup procedures.
i. Wiring diagrams, including factory-installed and field-installed wiring.
j. Sound/Noise data report. Manufacturer shall provide sound ratings. Noise warning labels shall be posted on equipment.
k. Refrigerant vapor detectors and monitors.

D. Run test report for all chillers.

E. Product Certificate: Signed by chiller manufacturer certifying that chillers furnished comply with AHRI requirements. The test report shall include calibrated curves, calibration records, and data sheets for the instrumentation used in factory tests.

F. 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.

1.6 QUALITY ASSURANCE

A. Comply with AHRI requirements for testing and certification of the chillers.

B. Refer to paragraph, WARRANTY, Section 01 00 00, GENERAL REQUIREMENTS, except as noted below:
1. Provide a 5-year motor, transmission, and compressor warranty to include materials, parts and labor.

C. Refer to OSHA 29 CFR 1910.95(a) and (b) for Occupational Noise Exposure Standard.

D. Refer to ASHRAE 15 for refrigerant vapor detectors and monitor.

E. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

F. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.7 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 ROTARY-SCREW AND SCROLL AIR-COOLED WATER CHILLERS

A. General: Factory assembled and factory tested rotary-screw or scroll water chillers, complete with evaporator, compressors, motor, starters, integral condenser, and controls mounted on a welded steel base. The chiller unit shall consist of two compressors minimum, but not more than eight, mounted on a single welded steel base. Where compressors are paralleled, not more than two shall be so connected and not less than two independent refrigerant circuits shall be provided. Provide chiller with refrigerant type R32. EPA approved refrigerants are listed at https://www.epa.gov/snap/. Submit proposed refrigerant for government approval.

B. Performance: Provide the capacity as shown on the contract drawings. Part load and full load efficiency ratings of the chiller shall not exceed those shown on the contract drawings. If chillers are required to operate at less than 25 percent of full unit rated capacity, specify provision for hot gas by-pass, to operate the unit stable at any stage of capacity reduction.

C. Capacity of a single air-cooled chiller shall not exceed 250 Tons (Standard AHRI Conditions).

D. Applicable Standard: Chillers shall be rated and certified according to AHRI 550/590, and shall be stamped in compliance with AHRI certification.

E. Acoustics: Sound pressure levels shall not exceed the following specified levels. The manufacturer shall provide sound treatment if required to comply with the specified maximum levels. Testing shall be in accordance with AHRI 370 requirements.

OCTAVE BAND								Overall
63	125	250	500	1000	2000	4000	8000	dB(A)
45.0	49.0	52.0	55.0	58.0	54.0	48.0	41.0	61.0

F. Compressor (Scroll Type): Three dimensional, positive-displacement, hermetically sealed design, with suction and discharge valves, crankcase oil heater and suction strainer. Compressor shall be mounted on vibration isolators. Rotating parts shall be factory balanced. Lubrication system shall consist of reversible, positive displacement pump, strainer, oil level sight glass, and oil charging valve. Capacity control shall be by on-off compressor cycling of single and multiple compressors and hot gas bypass.

G. Refrigerants Circuit: Each circuit shall contain include an expansion valve, refrigerant charging connections, hot-gas muffler, compressor suction and discharge shutoff valves, replaceable-core filter drier, sight glass with moisture indicator, liquid-line solenoid valve and insulated suction line.

H. Refrigerant and Oil: Sufficient volume of dehydrated refrigerant and lubricating oil shall be provided to permit maximum unit capacity operation before and during tests. Replace refrigerant charge lost during the warranty period, due to equipment failure, without cost to the Government.

I. Condenser:

1. Air-cooled integral condenser as shown on the contract drawings and specified hereinafter.
2. Integral Condenser: Condenser coils shall be extended surface fin and tube type, seamless copper tubes with aluminum fins. Refer to paragraph CORROSION PROTECTION. Condenser coils shall be factory air tested at 3102 kPa (450 psig). Condenser fans shall be propeller type, directly connected to motor shaft. Fans shall be statically and dynamically balanced, with wire safety guards. Condenser fan motors with permanently lubricated ball bearings and three phase thermal overload protection. Unit shall start -18 degrees C (0 degrees F) with external damper assemblies. Units shall have grilles factory mounted to prevent damage to coil surfaces.

J. Evaporator:

1. Brazed plate and frame type heat exchanger design. Brazed plate evaporator shall be constructed of stainless-steel with copper brazing material. The evaporator shall be designed for a minimum of 1.5 times the working pressure produced by the water system, but not less than 1034 kPa (150 psig). Refrigerant side working pressure shall comply with ASHRAE 15.

K. Evaporator for packaged air-cooled chiller units designed for outdoor installation shall be protected against freeze-up in ambient temperature down to -30 degrees C (-22 degrees F) by a resistance heater cable under insulation with thermostat set to operate below 3 degrees C (37.4 degrees F) ambient. If electric resistance heater is required and the chiller is connected to emergency power, provide emergency power to the heater cable.

L. Insulation: Evaporator, suction piping, compressor, and all other parts subject to condensation shall be insulated with 19 mm (3/4 inch) minimum thickness of flexible-elastomeric thermal insulation, complying with ASTM C534/C534M.

M. Refrigerant Receiver: Provide a liquid receiver for chiller units when system refrigerant charge exceeds 80 percent of condenser refrigerant volume. Liquid receivers shall be horizontal type, designed, fitted, and rated in conformance with AHRI 495. Receiver shall be constructed and tested in conformance with ASME BPVC Section VIII. Each receiver shall have a storage capacity not less than 20 percent in excess of that required for fully charged system. Each receiver shall be equipped with inlet, outlet drop pipes, drain plug, purging valve, and relief devices as required by ASHRAE 15.

N. Controls: Chiller shall be furnished with unit mounted, stand-alone, microprocessor-based controls in NEMA 1 enclosure, hinged and lockable, factory wired with a single point power connection and separate control circuit. The control panel provide chiller operation, including

monitoring of sensors and actuators, and shall be furnished with light emitting diodes or liquid-crystal display keypad.

1. The following shall display as a minimum on the panel:
   a. Date and time.
   b. Outdoor air temperature.
   c. Operating and alarm status.
   d. Entering and leaving water temperature-chilled water.
   e. Operating set points-temperature and pressure.
   f. Refrigerant temperature and pressure.
   g. Operating hours.
   h. Number of starts.
   i. Current limit set point.
   j. Maximum motor amperage (percent).
2. Control Functions:
   a. Manual or automatic startup and shutdown time schedule.
   b. Condenser water temperature.
   c. Entering and leaving chilled water temperature and control set points.
   d. Automatic lead-lag switch.
3. Safety Functions: The following conditions shall shut down the chiller and require manual reset to start.
   a. Loss of chilled water flow.
   b. Loss of condenser water flow (for water-cooled chillers only).
   c. Low chilled water temperature.
   d. Compressor motor current-overload protection.
   e. Freeze protection (for air-cooled chillers).
   f. Starter fault.
   g. High or low oil pressure.
   h. Recycling pumpdown.

O. The chiller control panel shall provide leaving chilled water temperature reset based on return water temperature, 4-20 ma or 0-10 VDC signal from Energy Control Center (ECC).

P. Provide contacts for remote start/stop, alarm for abnormal operation or shutdown, and for Engineering Control Center (ECC).

Q. Chiller control panel shall be BACnet interworking using ARCNET or MS/TP physical data link layer protocol for communication with building automation control system.

R. Auxiliary hydronic system and the chiller(s) shall be interlocked to provide time delay and start sequencing as indicated on control drawings.

S. Motor: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Compressor motor furnished with the chiller shall be in accordance with the chiller manufacturer and Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT. Starting torque of motors shall be suitable for driven machines.

T. Motor Starter: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide a starter in NEMA 1 enclosure, designed for floor or unit mounted chiller using multiple compressors, with the lead compressor starting at its minimum capacity shall be provided with across-the-line starter. See Section 26 29 11, MOTOR CONTROLLERS for additional requirements.

PART 3 – EXECUTION

3.1 EXAMINATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, piping and electrical to verify actual locations and sizes before chiller installation and other conditions that might affect chiller performance, maintenance, and operation. Equipment locations shown on the contract drawings are approximate. Determine exact locations before proceeding with installation.

3.2 EQUIPMENT INSTALLATION

A. Install chiller on concrete base with isolation pads or vibration isolators.
   1. Concrete base is specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
   2. Vibration isolator types and installation requirements are specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
   3. Anchor chiller to concrete base according to manufacturer’s written instructions.
   4. Charge the chiller with refrigerant, if not factory charged.
   5. Install accessories and any other equipment furnished loose by the manufacturer, including remote starter, remote control panel, and remote flow switches, according to the manufacturer written instructions and electrical requirements.
   6. Chillers shall be installed in a manner as to provide easy access for tube pull and removal of compressor and motors etc.

B. Install refrigerant monitoring and safety equipment in accordance with ASHRAE 15.

C. Install refrigerant piping as specified in Section 23 23 00, REFRIGERANT PIPING and ASHRAE 15.

D. Install thermometers and gauges as recommended by the manufacturer and/or as shown on the contract drawings.

E. Piping Connections:
   1. Make piping connections to the chiller for chilled water, condenser water, and other connections as necessary for proper operation and maintenance of the equipment.

2. Make equipment connections with flanges and couplings for easy removal and replacement of equipment from the equipment room.
3. Extend vent piping to the outside.

3.3 STARTUP AND TESTING

A. Engage manufacturer's factory-trained representative to perform startup and testing service.

B. Inspect, equipment installation, including field-assembled components, and piping and electrical connections.

C. After complete installation startup checks, according to the manufacturers written instructions, do the following to demonstrate to the COR that the equipment operate and perform as intended.

1. Check refrigerant charge is sufficient and chiller has been tested for refrigerant leak.
2. Check bearing lubrication and oil levels.
3. Verify proper motor rotation.
4. Verify pumps associated with chillers are installed and operational.
5. Verify thermometers and gauges are installed.
6. Verify purge system, if installed, is functional and relief piping is routed outdoor.
7. Operate chiller for run-in-period in accordance with the manufacturer’s instruction and observe its performance.
8. Check and record refrigerant pressure, water flow, water temperature, and power consumption of the chiller.
9. Test and adjust all controls and safeties. Replace or correct all malfunctioning controls, safeties and equipment as soon as possible to avoid any delay in the use of the equipment.
10. Prepare a written report outlining the results of tests and inspections, and submit it to the COR.

D. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

E. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

F. Coordinate the startup and contractor testing schedules with the COR. Provide a minimum notice of 10 working days prior to startup and testing.

3.5 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. Coordinate this training with that of the cooling tower, if furnished together.

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SECTION 23 72 00
AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. This section specifies air-to-air plate heat exchangers .

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.

H. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

I. Section 23 07 11, HVAC and BOILER PLANT INSULATION.

K. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

L. Section 23 21 13, HYDRONIC PIPING.

M. Section 23 21 23, HYDRONIC PUMPS.

N. Section 23 31 00, HVAC DUCTS and CASINGS.

O. Section 23 40 00, HVAC AIR CLEANING DEVICES.

P. Section 23 82 16, AIR COILS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. Air Conditioning, Heating, and Refrigeration Institute (AHRI):

1060-2018 ..... Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment

C. American Society of Civil Engineers (ASCE):

7-2016 ..... Minimum Design Loads for Associated Criteria for Buildings and Other Structures

D. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE):

15-2019 ..... Safety Standard for Refrigeration Systems

34-2022 ..... Designation and Classification of Refrigerants (ANSI)

52.2-2017 ..... Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

62.1-2019 ..... Ventilation for Acceptable Indoor Air Quality

84-2020 ..... Method of Testing Air-to-Air Heat/Energy Exchangers

E. American Society for Testing and materials (ASTM):

D635-2018 ..... Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

E84-2021a ..... Standard Test Method for Surface Burning Characteristics of Building Materials

F. Underwriters Laboratories, Inc (UL):

1812-2013(R2021) ..... Standard for Ducted Heat Recovery Ventilators

1815-2012(R2021) ..... Standard for Nonducted Heat Recovery Ventilators)

G. Department of Veterans Affairs (VA):

PG-18-10-2017(R2023)..... HVAC Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Plate Heat Exchanger

D. Certificate: Submit, simultaneously with shop drawings, an evidence of satisfactory service of the equipment on three similar installations.

E. Submit type, size, arrangement, and performance details. Present application ratings in the form of tables, charts, or curves.

F. 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. Refer to Section 01 00 00, GENERAL REQUIREMENTS for performance tests and instructions to VA personnel.

B. Performance Criteria: Heat recovery equipment shall be provided by a manufacturer who has been manufacturing such equipment and the equipment has a good track record for at least 3 years.

C. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

D. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 – PRODUCTS

2.1 AIR-TO-AIR PLATE HEAT EXCHANGER

A. Comply with UL 1812.

B. Plates: Corrugated 0.53 mm (0.021 inch) polypropylene copolymer (high density plastic spacing as recommended by the manufacturer.

C. Bedding: Thermosetting reinforced resin. Provide plate seal-off and passage separation at top, bottom and center divider. The resins shall be self-extinguishing type in accordance with ASTM D635.

D. Casing and End Strips: Casing of 1.6 mm (16 gauge) galvanized steel, except casings for corrosive air streams shall be stainless steel. End strips of the same material as exchanger plates. Ends of unit exchanger plates shall be sealed with high temperature silicon sealant prior to installation of end strip for corrosive air streams provide welded end strips to avoid cross contaminations.

E. Casings shall have integral flanges for flanged duct connections and shall have lifting holes or lugs.

F. Drain Pan: Same material as unit casing. Drain pan surface shall be covered with molded ABS and shall have drain connections on exhaust and supply side. Comply with requirements in ASHRAE 62.1.

G. Accessories: Furnish where indicated on the contract drawings.

1. Face and Bypass Dampers: Manufacturer's standard, complete with operators, with factory installed controls to operate face-and-bypass dampers during summer and winter.
2. Defrost System: Factory installed and capable of maintaining at least 85 percent of the non-frosted performance at -29 degrees C (-20 degrees F).

I. Extended-Surface, Disposable Panel Filters: MERV 7, 50 mm (2 inch) throw-away type. Refer to Section 23 40 00, HVAC AIR CLEANING DEVICES.

2.2 AIR FILTERS

A. Air Filters: Disposable air filters, with a MERV rating of 8, shall be provided as indicated on the contract drawings. Comply with requirements in Section 23 40 00, HVAC AIR CLEANING DEVICES.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Follow the equipment manufacturer's instructions for handling and installation and setting up of ductwork for makeup and exhaust air steamers for maximum efficiency.

C. Seal ductwork tightly to avoid air leakage.

D. Install units with adequate spacing and access for cleaning and maintenance of heat recovery coils as well as filters.

3.2 FIELD QUALITY CONTROL

A. Operational Test: Perform tests as per manufacturer’s written instructions for proper and safe operation of the heat recovery system.

1. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Adjust seals and purge.
3. Test and adjust controls and safeties.

B. Replace damaged and malfunctioning controls and equipment.

C. Set initial temperature and humidity set points. Set field-adjustable switches and circuit breaker trip ranges as indicated.

D. Prepare test and inspection reports to the COR in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. Coordinate the startup and contractor testing schedules with the COR. Provide a minimum notice of 10 working days prior to startup and testing.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4hours to instruct each VA personnel responsible in operation and maintenance of the system.

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SECTION 23 73 00
INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air handling units including integral components specified herein.

C. Definition of Air Handling Unit (AHU): A factory-fabricated and tested assembly of modular sections consisting of housed-centrifugal fan with V-belt drive or single or multiple plenum fans with direct-drive, coils, filters, and other necessary equipment to perform one or more of the following functions of circulating, cleaning, heating, cooling, humidifying, dehumidifying, and mixing of air. Design capacities of units shall be as scheduled in the contract documents.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 09 91 00, PAINTING.

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 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

H. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

I. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

J. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

K. Section 23 21 13, HYDRONIC PIPING.

L. Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.

M. Section 23 31 00, HVAC DUCTS and CASINGS.

N. Section 23 34 00, HVAC FANS.

O. Section 23 40 00, HVAC AIR CLEANING DEVICES.

P. Section 23 82 16, AIR COILS.

Q. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):

260-2017 ..... Sound Rating of Ducted Air Moving and Conditioning Equipment

410-2001 ..... Forced-Circulation Air-Cooling and Air-Heating Coils with Addenda 1, 2 and 3

430-2020 ..... Performance Rating of Central Station Air-Handling Unit Supply Fans

C. Air Movement and Control Association International, Inc. (AMCA):

99-2016 ..... Standards Handbook

210-2016 ..... Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating

D. American Bearing Manufacturers Association (ABMA):

9-2015(R2020)..... Load Ratings and Fatigue Life for Ball Bearings

E. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):

51-2016 ..... Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating

170-2021 ..... Ventilation of Health Care Facilities

F. American Society for Testing and Materials (ASTM):

A653/A653M-2020 ..... Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

B117-2019 ..... Standard Practice for Operating Salt Spray (Fog) Apparatus

D1654-2008(R2016)e1..... Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

D1735-2014 ..... Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus

D3359-2017 ..... Standard Test Methods for Rating Adhesion by Tape Test

G152-2013(R2021) ..... Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

G. Energy Policy Act of 2005 (P.L.109-58)

H. Military Specifications (Mil. Spec.):

P-21035B-2021..... Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

I. National Fire Protection Association (NFPA):

70-2020 ..... National Electrical Code

90A-2021 ..... Standard for Installation of Air-Conditioning and Ventilating Systems

J. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

016-2012 ..... HVAC Air Duct Leakage Test Manual, 2nd Edition

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Submittals for AHUs shall include fans, motors, coils, mixing box with outside/return air dampers, filter housings, blender sections, and all other related accessories. The contractor shall provide custom drawings showing total air handling unit assembly including dimensions, operating weight, access sections, diffusion plates, flexible connections, door swings, controls penetrations, electrical disconnect, lights, duplex receptacles, switches, wiring, utility connection points, unit support system, vibration isolators, drain pan, pressure drops through each component (filter, coil etc).
2. Submittal drawings of section or component only will not be acceptable. Contractor shall also submit performance data including performance test results, charts, curves, or certified computer selection data; data sheets; fabrication and insulation details. If the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements.
3. Submit sound power levels in each octave band for the inlet and discharge of the fan and at entrance and discharge of AHUs at scheduled conditions. In absence of sound power ratings refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
4. Provide fan curves showing CFM (cubic feet per minute), static pressure, efficiency, and horsepower for design point of operation and at maximum design CFM (cubic feet per minute).
5. Submit total fan static pressure, external static pressure, for AHU including total, inlet and discharge pressures, and itemized specified internal losses and unspecified internal losses. Refer to air handling unit schedule in the contract documents.

D. Submit written test procedures two weeks prior to factory testing. Submit written results of factory tests for approval prior to shipping.

E. Submit shipping information that clearly indicates how the units will be shipped in compliance with the descriptions below.

1. Units shall be shipped in one (1) piece where possible and in shrink wrapping to protect the unit from dirt, moisture and/or road salt.

2. If not shipped in one (1) piece, provide manufacturer approved shipping splits where required for installation or to meet shipping and/or job site rigging requirements in modular sections. Indicate clearly that the shipping splits shown in the submittals have been verified to accommodate the construction constraints for rigging as required to complete installation and removal of any section for replacement through available access without adversely affecting other sections.
3. If shipping splits are provided, each component shall be individually shrink wrapped to protect the unit and all necessary hardware (e.g., bolts, gaskets etc.) will be included to assemble unit onsite.
4. Lifting lugs shall be provided to facilitate rigging on shipping splits and joining of segments. If the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include instructions for lubrication, filter replacement, motor and drive replacement, and spare parts list.
3. Include complete diagrams of the internal wiring for each item of equipment.
4. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Comply with requirements in paragraph QUALITY ASSURANCE of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
B. Air Handling Units Certification:
1. Air Handling Units with Housed Centrifugal Fans: The air handling units shall be certified in accordance with AHRI 430 and tested/rated in accordance with AHRI 260.
2. Air Handling Units with Plenum Fans:
a. Air Handling Units with a single Plenum Fan shall be certified in accordance with AHRI 430 and tested/rated in accordance with AHRI 260.
b. Air handling Units with Multiple Fans in an Array shall be tested and rated in accordance with AHRI 430 and AHRI 260.
C. Heating, Cooling, and Air Handling Capacity and Performance Standards: AHRI 430, AHRI 410, ASHRAE 51, and AMCA 210.
D. Performance Criteria:
1. The fan BHP shall include all system effects for all fans and v-belt drive losses for housed centrifugal fans.

2. The fan motor shall be selected within the rated nameplate capacity, without relying upon NEMA Standard Service Factor.
3. Select the fan operating point as follows:
   a. Forward Curve and Axial Flow Fans: Right hand side of peak pressure point.
   b. Air Foil, Backward Inclined, or Tubular Fans Including Plenum Fans: At or near the peak static efficiency but at an appropriate distance from the stall line.
4. Operating Limits: AMCA 99 and manufacturer's recommendations.

E. Units shall be factory-fabricated, assembled, and tested by a manufacturer, in business of manufacturing similar air-handling units for at least five (5) years.

F. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

G. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 – PRODUCTS

2.1 AIR HANDLING UNITS

A. General:
1. AHUs shall be fabricated from insulated, solid double-wall galvanized steel without any perforations in draw-through configuration. Galvanizing shall be hot dipped conforming to ASTM A653/A653M and shall provide a minimum of 0.275 kg of zinc per square meter (0.97 oz. of zinc per square foot) (G90). Aluminum constructed units, subject to VA approval, may be used in place of galvanized steel. The unit manufacturer shall provide published documentation confirming that the structural rigidity of aluminum air-handling units is equal or greater than the specified galvanized steel.
2. The contractor and the AHU manufacturer shall be responsible for ensuring that the unit will not exceed the allocated space shown in the contract documents, including required clearances for service and future overhaul or removal of unit components. All structural, piping, wiring, and ductwork alterations of units, which are dimensionally different than those specified, shall be the responsibility of the contractor at no additional cost or time to the Government.
3. AHUs shall be fully assembled by the manufacturer in the factory in accordance with the arrangement shown in the contract documents. The unit shall be assembled into the largest sections possible subject to shipping and rigging restrictions. The correct fit of all components

and casing sections shall be verified in the factory for all units prior to shipment. All units shall be fully assembled, tested, and then split to accommodate shipment and job site rigging. On units not shipped fully assembled, the manufacturer shall tag each section and include air flow direction to facilitate assembly at the job site. Lifting lugs or shipping skids shall be provided for each section to allow for field rigging and final placement of unit.

4. The AHU manufacturer shall provide the necessary gasketing, caulking, and all screws, nuts, and bolts required for assembly. The manufacturer shall provide a factory-trained and qualified local representative at the job site to supervise the assembly and to assure that the units are assembled to meet manufacturer's recommendations and requirements noted in the contract documents. Provide documentation to the COR that the local representative has provided services of similar magnitude and complexity on jobs of comparable size. If a local representative cannot be provided, the manufacturer shall provide a factory representative.
5. Gaskets: All door and casing and panel gaskets and gaskets between air handling unit components, if joined in the field, shall be high quality which seal airtight and retain their structural integrity and sealing capability after repeated assembly and disassembly of bolted panels and opening and closing of hinged components. Bolted sections may use a more permanent gasketing method provided they are not disassembled.
6. Structural Rigidity: Provide structural reinforcement when required by span or loading so that the deflection of the assembled structure shall not exceed 1/200 of the span based on a differential static pressure of 2000 Pa (8 inch WG) or higher.

B. Base:

1. Provide a heavy duty steel base for supporting all major AHU components. Bases shall be constructed of wide-flange steel I-beams, channels, or minimum 127 mm (5 inch) high 3.5 mm (10 Gauge) steel base rails. Welded or bolted cross members shall be provided as required for lateral stability. Contractor shall provide supplemental steel supports as required to obtain proper operation heights for cooling coil condensate drain trap.
2. AHUs shall be completely self-supporting for installation on concrete housekeeping pad, steel support pedestals, or suspended as shown in the contract documents.
3. The AHU bases not constructed of galvanized steel shall be cleaned, primed with a rust inhibiting primer, and finished with rust inhibiting exterior enamel.

C. Casing (Including Wall, Floor, and Roof):

1. General: AHU casing shall be constructed as solid double wall, galvanized steel insulated panels without any perforations, integral of or attached to a structural frame. The thickness of insulation, mode of application and thermal breaks shall be such that there is no visible condensation on the exterior panels of the AHU located in the non-conditioned spaces.
2. Casing Construction:

Outer Panel	0.8 mm (22 Gauge) Minimum
Inner Panel	0.8 mm (22 Gauge) Minimum
Insulation Thickness Density	Foam 50 mm (2 inch) Minimum 48 kg/m^3 (3.0 lb/ft^3) Minimum
Total R Value	2.3 m^2.K/W (13.0 ft^2.^{O}F.hr/Btu) Minimum

3. Blank-Off: Provide blank-offs as required to prevent air bypass between the AHU sections, around coils, and filters.
4. Casing panels shall be secured to the support structure with stainless-steel or zinc-chromate plated screws and gaskets installed around the panel perimeter. Panels shall be completely removable to allow removal of fan, coils, and other internal components for future maintenance, repair, or modifications. Welded exterior panels are prohibited.
5. Access Doors: Provide in each access section and where shown in the contract documents. Show single-sided and double-sided access doors with door swings on the floor plans. Doors shall be a minimum of 50 mm (2 inch) thick with same double wall construction as the unit casing. Doors shall be a minimum of 610 mm (24 inches) wide, unless shown of different size in the contract documents, and shall be the full casing height up to a maximum of 1829 mm (6 feet). Doors shall be gasketed, hinged, and latched to provide an airtight seal. The access doors for fan section, mixing box, and coil section shall include a minimum 152 mm x 152 mm (6 inch x 6 inch) double thickness, with air space between the glass panes tightly sealed, reinforced glass or Plexiglas window in a gasketed frame.
   a. Hinges: Manufacturer's standard, designed for door size, weight and pressure classifications. Hinges shall hold door completely rigid with minimum 45 kg (100 lb) weight hung on latch side of door.
   b. Latches: Non-corrosive alloy construction, with operating levers for positive cam action, operable from either inside or outside. Doors that do not open against unit operating pressure shall allow the door to ajar and then require approximately 0.785 radian (45 degrees) further movement of the handle for complete opening. Latch shall be capable of restraining explosive opening of door with a force not less than 2000 Pa (8 inch WG).
   c. Gaskets: Neoprene, continuous around door, positioned for direct compression with no sliding action between the door and gasket. Secure with high quality mastic to eliminate possibility of gasket slipping or coming loose.
6. Provide sealed sleeves, metal or plastic escutcheons or grommets for penetrations through casing for power and temperature control wiring and pneumatic tubing. Coordinate with electrical and temperature control subcontractors for number and location of penetrations. Coordinate lights, switches, and duplex receptacles and disconnect switch location and

mounting. All penetrations and equipment mounting may be provided in the factory or in the field. All field penetrations shall be performed neatly by drilling or saw cutting. No cutting by torches will be allowed. Neatly seal all openings airtight.

D. Floor:

1. Unit floor shall be level without offset space or gap and designed to support a minimum of 488 kg/square meter (91 lbs per square foot) distributed load without permanent deformation or crushing of internal insulation. Provide adequate structural base members beneath floor in service access sections to support typical service foot traffic and to prevent damage to unit floor or internal insulation. Unit floors in casing sections, which may contain water or condensate, shall be watertight with drain pan.
2. Where indicated, furnish and install floor drains flush with the floor, with nonferrous grate cover and stub through floor for external connection.

E. Condensate Drain Pan: Drain pan shall be designed to extend entire length of cooling coils including headers and return bends. Depth of drain pan shall be at least 43 mm (1.7 inches) and shall handle all condensate without overflowing. Drain pan shall be double-wall, double sloping type, and fabricated from stainless-steel (304) with at least 50 mm (2 inch) thick insulation sandwiched between the inner and outer surfaces. Drain pan shall be continuous metal or welded watertight. No mastic sealing of joints exposed to water will be permitted. Drain pan shall be placed on top of casing floor or integrated into casing floor assembly. Drain pan shall be pitched in all directions to drain line.

1. An intermediate, stainless-steel (304) condensate drip pan with copper downspouts shall be provided on stacked cooling coils. Use of intermediate condensate drain channel on upper casing of lower coil is permissible provided it is readily cleanable. Design of intermediate condensate drain shall prevent upper coil condensate from flowing across face of lower coil.
2. Drain pan shall be piped to the exterior of the unit. Drain pan shall be readily cleanable.
3. Installation, including frame, shall be designed and sealed to prevent blow-by.

F. Housed Centrifugal Fan Sections:

1. Fans shall be minimum Class II construction, double width, double inlet centrifugal, air foil, backward inclined or forward curved type as indicated in the contract documents, factory balanced and rated in accordance with AMCA 210 or ASHRAE 51. Provide self-aligning, pillow block, regreasable ball-type bearings selected for a B (10) life of not less than 50,000 hours and an L (50) average fatigue life of 200,000 hours per ABMA 9. Extend bearing grease lines to motor and drive side of fan section. Fan shall be located in airstream to assure proper air flow.
2. Provide internally vibration isolated fan, motor and drive, mounted on a common integral bolted or welded structural steel base with adjustable motor slide rail with locking device. Provide vibration isolators and flexible duct connections at fan discharge to completely isolate

fan assembly. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT, for additional requirements.

3. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal, and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. Following fan assembly, the complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).

G. Fan Motor, Drive, and Mounting Assembly (Housed Centrifugal Fans):

1. Fan Motor and Drive: Motors shall be premium energy efficient type, as mandated by the Energy Policy Act of 2005, with efficiencies as shown in Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT, in the contract documents and suitable for use in variable frequency drive applications on AHUs where this type of drive is indicated. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC, for additional motor and drive specifications. Refer to Section 26 29 11, MOTOR CONTROLLERS.
2. Fan drive and belts shall be factory mounted with final alignment and belt adjustment to be made by the Contractor after installation. Drive and belts shall be as specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide additional drive(s) if required during balancing, to achieve desired airflow.

H. Plenum Fans – Single and/or Multiple Fans in an Array:

1. General: Fans shall be Class II (minimum) construction with single inlet, aluminum wheel and stamped air-foil aluminum bladed. The fan wheel shall be mounted on the directly-driven motor shaft in AMCA Arrangement 4. Fans shall be dynamically balanced and internally isolated to minimize the vibrations. Provide a steel inlet cone for each wheel to match with the fan inlet. Locate fan in the air stream to assure proper flow. The fan performance shall be rated in accordance with AMCA 210 or ASHRAE 51.
2. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal, and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41,

NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. Following fan assembly, the complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).

3. The plenum fans shall be driven by variable speed drives with at least one back-up drive as shown in the design documents. Use of a drive with bypass is prohibited.
4. Multiple fans shall be installed in a pre-engineered structural frame to facilitate fan stacking. All fans shall modulate in unison, above or below the synchronous speed within the limits specified by the manufacturer, by a common control sequence. Staging of the fans is prohibited. Redundancy requirement shall be met by all operating fans in an array and without the provision of an idle standby fan.
5. Fan Accessories:
   a. Fan Isolation: Provide an automatic back draft damper to isolate the fan not in operation due to failure.
   b. Fan Airflow Measurement: Provide an airflow measuring device integral to the fan to measure air volume within +/- 5 percent accuracy. The probing device shall not be placed in the airflow path to stay clear of turbulence and avoid loss of performance.

I. Fan Motor and Drive (Plenum Fans): Motors shall be premium energy efficient type, as mandated by the Energy Policy Act of 2005, with efficiencies as shown in Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT, in the contract documents and suitable for use in variable frequency drive applications. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC, for additional motor and drive specifications. Refer to Section 26 29 11, MOTOR CONTROLLERS.

J. Filter Section: Refer to Section 23 40 00, HVAC AIR CLEANING DEVICES, for filter requirements.
   1. Filters including one complete set for temporary use at site shall be provided independent of the AHU. The AHU manufacturer shall install filter housings and racks in filter section compatible with filters furnished. The AHU manufacturer shall be responsible for furnishing temporary filters (pre-filters and after-filters, as shown in the contract documents) required for AHU testing.
   2. Factory-fabricated filter section shall be of the same construction and finish as the AHU casing including filter racks and hinged double wall access doors.

K. Coils: Coils shall be mounted on hot dipped galvanized steel supports to assure proper anchoring of coil and future maintenance. Coils shall be face or side removable for future replacement thru the access doors or removable panels. Each coil shall be removable without disturbing adjacent

coil. Cooling coils shall be designed and installed to ensure no condensate carry over. Provide factory-installed extended supply, return, drain, and vent piping connections. Refer to the contract documents and Section 23 82 16, AIR COILS for additional coil requirements.

1. Water coils.

L. Sound Attenuators: Refer to the contract documents, Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT, and Section 23 31 00, HVAC DUCTS AND CASINGS, for additional unit mounted sound attenuator requirements. AHU sound attenuators shall be factory-installed as an integral part of AHU.

M. Discharge Section: Provide aerodynamically designed framed discharge openings or spun bellmouth fittings to minimize pressure loss.

N. Electrical and Lighting: Wiring and equipment specifications shall conform to Division 26, ELECTRICAL.

1. Vapor-proof lights using cast aluminum base style with glass globe and cast aluminum guard shall be installed in access sections for fan, mixing box, and any section over 305 mm (12 inch) wide. A single switch shall control all lights in the unit with a pilot light mounted on the outside. Wiring between switches and lights shall be factory-installed. All wiring shall run in neatly installed electrical conduits and terminate in a junction box for field connection to the building system. Provide single point 115 volt - one phase connection at junction box.
2. Install compatible LED bulb in each light fixture.
3. Provide a convenience duplex receptacle next to the light switch.
4. Disconnect switch and power wiring: Provide factory or field mounted disconnect switch. Coordinate with Division 26, ELECTRICAL.
5. Provide single point power connection. Coordinate with Division 26, ELECTRICAL.

PART 3 – EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Install air handling unit in conformance with AHRI 430.

C. Assemble air handling unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas with paint in accordance with Mil. Spec. P-21035B. Repair painted units by touch up of all scratches with finish paint material. Vacuum the interior of air handling units clean prior to operation.

D. Leakage and test requirements for air handling units shall be the same as specified for ductwork in Section 23 31 00, HVAC DUCTS AND CASINGS except leakage shall not exceed Leakage Class (C_L) 12 listed in SMACNA HVAC Air Duct Leakage Test Manual when tested at 1.5 times the design static pressure. Repair casing air leaks that can be heard or felt during normal operation and to meet test requirements.

E. Perform field mechanical (vibration) balancing in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

F. Seal and/or fill all openings between the casing and AHU components and utility connections to prevent air leakage or bypass.

3.2 STARTUP AND TESTING

A. The air handling unit shall not be operated for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings are lubricated, and the fan has been test run under observation.

B. After the air handling unit is installed and tested, provide startup and operating instructions to VA personnel.

C. An authorized factory representative should startup, test, and certify the final installation and application specific calibration of control components. Items to be verified include fan performance over entire operating range, noise and vibration testing, verification of proper alignment, overall inspection of the installation, Owner/Operator training, etc.

D. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

E. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

F. Coordinate the startup and contractor testing schedules with the COR. Provide a minimum notice of 10 working days prior to startup and testing.

3.3 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.

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SECTION 23 82 00
CONVECTION HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. This section specifies room fan-coil units, radiant ceiling panels, and finned-tube radiation.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

F. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

G. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

H. Section 23 21 13, HYDRONIC PIPING.

I. Section 23 31 00, HVAC DUCTS AND CASINGS.

J. Section 23 82 16, AIR COILS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. Air-Conditioning, Heating, and Refrigeration Institute (ANSI/AHRI):
440-2019 ..... Performance Rating of Fan-Coil Units

C. National Fire Protection Association (NFPA):
70-2020 ..... National Electrical Code
90A-2021 ..... Standard for the Installation of Air-Conditioning and Ventilating Systems

D. Underwriters Laboratories, Inc. (UL):
181-2013(R2017)..... Standard for Factory-Made Air Ducts and Air Connectors
1995-2015(R2018)..... Heating and Cooling Equipment

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Room Fan-Coil units.
   4. Finned-tube radiation.
   5. Radiant ceiling panels.
D. Certificates:
   1. Compliance with paragraph QUALITY ASSURANCE.
   2. Compliance with specified standards.
E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Refer to paragraph QUALITY ASSURANCE of Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide guarantee in accordance with FAR clause 52.246-21.
B. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.
C. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 ROOM FAN-COIL UNITS

A. Capacity Certification: AHRI 440.
B. Safety Compliance: NEC compliant and UL listed.
C. Noise Levels: Operating at full cooling capacity, sound power level shall not exceed by more than 5 dB the numerical value of sound pressure levels associated with noise criteria specified in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Select units at intermediate speed, for compliance with the noise criteria.
D. Chassis: Galvanized steel, acoustically and thermally insulated to attenuate noise and prevent condensation.

E. Cabinet: Minimum 1.3 mm (l8 gauge) steel reinforced and braced. Arrange components and provide extended sections (if required) to allow adequate space for installation and maintenance of the field installed piping package and control valves. Finish shall be factory-baked enamel in manufacturer's standard color as selected by the architect on all exposed surfaces.

l. Vertical Exposed Cabinet Unit: Provide 1.6 mm (l6 gauge) steel front panel with 13 mm (l/2 inch) thick fiberglass insulation and provide screw-type levelers.

a. Air Outlet Grilles: Adjustable four-way air deflection located in the top panel.

b. Provide two hinged access doors (one each side) equipped with key operated cam-lock fasteners in the unit top panel located to provide access to the unit controls.

2. Horizontal Unit: Provide exposed or concealed type as indicated on drawings. Provide supports and vibration isolators for horizontal units as recommended by the manufacturer.

a. Concealed Units: Provide furred-in type with inlet and outlet duct collars.

c. Exposed Units: Fully enclosed cabinet with hinged bottom access panel with cam-lock fasteners. Provide stamped integral inlet and discharged grilles or inlet and outlet duct collars, as indicated on drawings.

F. Fans: Centrifugal, forward curved, double width type wheels, galvanized steel or polyester resin construction, statically and dynamically balanced, direct driven.

l. Motors: Premium efficiency, brushless DC (BLDC)/electronically commutated motors (ECM) factory-programmed and run-tested in assembled units. The motor controller shall be mounted in a touch-safe control box with a built-in integrated user interface and LED tachometer. If adjustments are needed, motor parameters shall be adjusted through momentary contact switches accessible without factory service personnel on the motor control board. Motors shall soft-ramp between speeds to lessen the acoustics due to sudden speed changes. Motors shall be operated at three speeds or with a field-supplied variable speed controller to perform the indicated sequence of operations. The motor shall choose the highest speed if there are simultaneous/conflicting speed requests. All motors shall have integral thermal overload protection with a maximum ambient operating temperature of 104°F and shall be permanently lubricated. Motors shall be capable of starting at 50 percent of rated voltage and operating at 90 percent of rated voltage on all speed settings. Motors shall operate up to 10 percent over voltage.

2. Provide a fan speed selector switch, with off, low, medium, and high positions. Switch shall have a set of auxiliary contacts which are open when the switch is in the "off" position and closed when the switch in any of the other positions. Mount switch in a junction box in the cabinet of each unit. Where the "off" position of the speed switch does not afford disconnect of electric power to the fan motor and all electric devices and controls, a toggle type disconnect switch shall be furnished with each unit.

G. Cooling and Heating Coils:
   1. Hydronic (two separate coils for cooling and heating): Copper tubes, 10 mm (3/8 inch) minimum inside diameter, not less than 0.43 mm (0.0l7 inch) thick with copper or aluminum fins. Coils shall be pressure tested for bursting and strength in accordance with Underwriters Laboratories, Inc., requirements for pressure tested coils, and shall be designed to provide adequate heat transfer capacity. Provide manual air vent at high point of each coil and drain at each low point.

H. Piping Package: Field-installed by the contractor to fit control valves provided by the controls' supplier. Submit manufacturer's detailed drawings of the piping package(s) and assure they will fit within the fan coil unit end compartments for approval prior to fabrication of the piping packages. Provide piping components as detailed on the drawings. Piping packages shall match manufacturer of other piping packages on the project. Piping packages by fan coil unit manufacturer will not be acceptable.

I. Drain Pans: Furnish galvanized steel with solderless drain connections and molded polystyrene foam insulating liner:
   1. Auxiliary Drain Pan: Located under control valve and piping within the unit enclosure to prevent dripping.
   2. Secondary Drain Pan: Where the unit is located such that drain pan overflow will damage the building, provide a secondary drain pan located underneath the unit, constructed to extend a minimum of 50 mm (2 inches) beyond the edges of the unit and be a minimum of 38 mm (1-1/2 inches deep) provided with a separate drain line discharging to conspicuous point. An overflow switch in the primary drain pan inside of and integral to the unit to deactivate the cooling in the unit is an acceptable alternative to providing a secondary drain pan.

J. Air Filter: Manufacturer's standard throwaway type, not less than 25 mm (1 inch) thick, MERV 7, supported to be concealed from sight and be tight fitting to prevent air by-pass. Filters shall have slide out frames and be easily replaced without removing enclosure or any part thereof.

K. Controls: Provide wall mounted thermostats unless shown otherwise on drawings.

2.2 UNIT HEATERS

A. General: Horizontal or vertical discharge type for hot water or electric heating medium, as indicated on drawings.

B. Casing: Steel sheet, phosphatized to resist rust and finished in baked enamel. Provide hanger supports.

C. Fan: Propeller type, direct driven by manufacturer's standard electric motor. Provide resilient mounting. Provide fan guard for horizontal discharge units.

D. Discharge Air Control:
   1. Horizontal Discharge: Horizontal, adjustable louvers.
   2. Vertical Discharge: Radial louver diffuser.

E. Hot Water Coil: Aluminum fins bonded to seamless copper tubing by mechanical expansion of the tubing, designed for 520 kPa (75 psig) working pressure.

F. Electric Units: UL listed, factory wired to terminal strips for field connection of power and control wiring.

1. Heating Elements: Nickel chromium alloy resistance wire embedded in a magnesium oxide insulating refractory and sealed in corrosion resisting metallic sheath with fins. Three phase heaters shall have balanced phases.
2. Thermal Cutout: Manual reset type, which disconnects elements, and motor in the event normal operating temperatures are exceeded.
3. Magnetic Contactor: Factory-installed with low voltage relay for remote pilot duty thermostat operation.

G. Controls: Provide low voltage wall mounted thermostats (may require low-voltage control kit) unless shown otherwise on drawings.

2.3 FINNED-TUBE RADIATION UNITS

A. Enclosures: 1.6 mm (l6 gauge) steel, sloping top, designed for wall mounting. Provide baked enamel finish in standard manufacturer's colors as selected by the Architect. End plates and corner pieces shall be die-formed with round edges and fit flush with enclosure surface. Where continuous wall-to-wall installations are shown in the contract documents provide all fillers, corner fittings, sleeves, end caps and other accessories, which shall have the same profile as the basic unit. Provide access panels or extensions where required for access to valves, and accessories as indicated in the contract documents.

B. Hydronic Heating Elements: Steel pipe or nonferrous tubing with fins mechanically bonded by mechanical expansion of the tube. Elements shall be positively positioned front-to-back with provisions for silent horizontal expansion and contraction.

C. Electric Heating Elements: Cal-rod electric resistance type inside aluminum tubes, mechanically expanded into fins and suspended between junction boxes. Provide capillary type automatic reset thermal cutout for immediate overheat protection. Front panel temperature shall not exceed 54 degrees C (l30 degrees F). Units shall be UL approved.

D. Controls: Provide wall mounted thermostats unless shown otherwise on drawings.

2.4 RADIANT CEILING PANELS

A. Electric Heating Panels: UL listed, 0.48 mm (26 gauge) steel backplate, 0.6 mm (24 gauge) steel faceplate, with 25 mm (1 inch) thick insulation between plates and over radiant panel. Finish with two coats flat white baked-on polyester paint for lay-in installation in an exposed "T" suspended ceiling.

1. Controls: Provide low voltage wall thermostats and required control transformers, relays, and contactors for installation by the Electrical Contractor.

B. Hydronic Radiant Panels: Lay-in type, 1 mm (0.04) inch aluminum faceplate with 13 mm (l/2 inch) I.D copper serpentine water coil mechanically bonded to faceplate, finished with two coats baked white polyester finish with a light reflection value of 70 to 80 percent. Panels shall weigh no greater than 0.68 kg (l.5 pounds) per square foot when filled with water. Provide 75 mm (3 inch) un-faced fiberglass blanket insulation pre-cut for installation above panels. Panels shall be 1 feet x 5 feet) continuous linear arranged as shown in the contract documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Work shall be installed as shown and according to the manufacturer’s diagrams and recommendations.

C. Handle and install units in accordance with manufacturer's written instructions.

D. Support units rigidly so they always remain stationary. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.

E. Where the "off" position of the speed switch does not afford disconnect of electric power to the fan motor and all electric controls and devices, the toggle disconnect switch specified above shall be turned over to the Electrical Contractor for installation within the unit wiring compartment.

F. Install fiberglass blanket insulation with a minimum R value of 8 above hydronic radiant panels.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. Coordinate the startup and contractor testing schedules with the COR. Provide a minimum notice of 10 working days prior to startup and testing.

3.3 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.

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SECTION 23 82 16
AIR COILS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Heating and cooling coils for air handling units, air terminal units, and duct applications.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEMS AND HVAC.

F. Section 23 31 00, HVAC DUCTS AND CASINGS.

G. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.

H. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. Air Conditioning and Refrigeration Institute (AHRI):
Directory of Certified Applied Air Conditioning Products
AHRI 4I0-2001 ..... Forced-Circulation Air-Cooling and Air-Heating Coils

C. American Society for Testing and Materials (ASTM):
B75/75M-2020 ..... Standard Specifications for Seamless Copper Tube

D. National Electric Manufacturers Association (NEMA):
250-2020 ..... Enclosures for Electrical Equipment (1,000 Volts Maximum)

E. National Fire Protection Association (NFPA):
70-2020 ..... National Electric Code

F. Underwriters Laboratories, Inc. (UL):
1996-2021 ..... Electric Duct Heaters

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Submit type, size, arrangements, and performance details. Present application ratings in the form of tables, charts, or curves.
D. Provide installation, operating and maintenance instructions.
E. Certification Compliance: Evidence of listing in current AHRI Directory of Certified Applied Air Conditioning Products.
F. 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. Refer to paragraph QUALITY ASSURANCE of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
B. Unless specifically exempted by these specifications, heating and cooling coils shall be tested, rated, and certified in accordance with AHRI 4l0 and shall bear the AHRI certification label.
C. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.
D. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 HEATING AND COOLING COILS

A. Conform to ASTM B75/75M and AHRI 410.
B. Tubes: Minimum 16 mm (0.625 inch) tube diameter; Seamless copper tubing.
C. Fins: 0.1397 mm (0.0055 inch) aluminum or 0.1143 mm (0.0045 inch) copper mechanically bonded or soldered or helically wound around tubing.
D. Headers: Copper, welded steel or cast-iron. Provide seamless copper tubing or resistance welded steel tube for volatile refrigerant coils.
E. "U" Bends, Where Used: Machine die-formed, silver brazed to tube ends.

F. Coil Casing: 1.6 mm (l6 gauge) galvanized steel with tube supports at 1219 mm (48 inch) maximum spacing. Construct casing to eliminate air bypass and moisture carry-over. Provide duct connection flanges.

G. Pressures kPa (PSIG):

Pressure	Water Coil	Refrigerant Coil
Test	2070 (300)	2070 (300)
Working	1380 (200)	1724 (250)

H. Protection: Unless protected by the coil casing, provide cardboard, plywood, or plastic material at the factory to protect tube and finned surfaces during shipping and construction activities.

I. Vents and Drain: Coils that are not vented or drainable by the piping system shall have capped vent/drain connections extended through coil casing.

2.2 REHEAT COILS, DUCT MOUNTED

A. The coils shall be continuous circuit booster type for hot water as shown in contract documents. Use the same coil material as listed in paragraph HEATING AND COOLING COILS.

2.3 WATER COILS, INCLUDING GLYCOL-WATER

A. Use the same coil material as listed in paragraph HEATING AND COOLING COILS.

B. Drainable Type (Self-Draining, Self-Venting); Manufacturer Standard:

1. Cooling, all types.
2. Heating or preheat.
3. Runaround energy recovery. AHRI certification of capacity adjustment is waived. See Section 23 72 00, AIR-TO-AIR ENERGY RECOVERY EQUIPMENT.

C. Cleanable Tube Type; Manufacturer Standard:

1. Well water applications.
2. Wastewater applications.

2.4 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 R410A or other EPA approved refrigerants.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Follow coil manufacturer's instructions for handling, cleaning, installation, and piping connections.

C. Comb fins, if damaged. Eliminate air bypass or leakage at coil sections.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. Coordinate the startup and contractor testing schedules with the COR. Provide a minimum of 10 working days prior to startup and testing.

3.3 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 4 hours to instruct VA personnel responsible in operation and maintenance of the system.

- - - E N D - - -

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, panelboards, 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, freeze and rain.
   1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
   2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
   3. Damaged equipment shall be repaired or replaced, as determined by the COR.

4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

A. All electrical work shall comply with requirements of the latest NFPA 70 (NEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, NFPA 780, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. However, energized electrical work may be performed only for the non-destructive and non-invasive diagnostic testing(s), or when scheduled outage poses an imminent hazard to patient care, safety, or physical security. In such case, all aspects of energized electrical work, such as the availability of appropriate/correct personal protective equipment (PPE) and the use of PPE, shall comply with the latest NFPA 70E, as well as the following requirements:

1. Only Qualified Person(s) shall perform energized electrical work. Supervisor of Qualified Person(s) shall witness the work of its entirety to ensure compliance with safety requirements and approved work plan.
2. At least two weeks before initiating any energized electrical work, the Contractor and the Qualified Person(s) who is designated to perform the work shall visually inspect, verify and confirm that the work area and electrical equipment can safely accommodate the work involved.
3. At least two weeks before initiating any energized electrical work, the Contractor shall develop and submit a job specific work plan, and energized electrical work request to the COR, and Medical Center's Chief Engineer or his/her designee. At the minimum, the work plan must include relevant information such as proposed work schedule, area of work, description of work, name(s) of Supervisor and Qualified Person(s) performing the work, equipment to be used, procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
4. Energized electrical work shall begin only after the Contractor has obtained written approval of the work plan, and the energized electrical work request from the COR, and Medical Center's Chief Engineer or his/her designee. The Contractor shall make these approved documents present and available at the time and place of energized electrical work.
5. Energized electrical work shall begin only after the Contractor has invited and received acknowledgment from the COR, and Medical Center's Chief Engineer or his/her designee to witness the work.

D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working spaces or working clearances shall comply with NEC's requirements, at a minimum.

C. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

1.11 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

C. Install adhesive arc flash warning labels on all equipment as required by the latest NFPA 70E. Label shall show specific and correct information for specific equipment based on its arc flash calculations. Label shall show the followings:
   1. Nominal system voltage.
   2. Equipment/bus name, date prepared, and manufacturer name and address.
   3. Arc flash boundary.
   4. Available arc flash incident energy and the corresponding working distance.
   5. Minimum arc rating of clothing.
   6. Site-specific level of PPE.

1.12 SUBMITTALS

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

B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.

C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
   1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
   2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
   3. Submit each section separately.

E. The submittals shall include the following:
   1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
   3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
   4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:

1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
   b. A control sequence describing start-up, operation, and shutdown.
   c. Description of the function of each principal item of equipment.
   d. Installation instructions.
   e. Safety precautions for operation and maintenance.
   f. Diagrams and illustrations.
   g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
   h. Performance data.
   i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
   j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the COR with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.
4. Duct sealing compound.

5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.14 ACCEPTANCE CHECKS AND TESTS

A. The Contractor shall furnish the instruments, materials, and labor for tests.

B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer's representatives and technicians so that a complete, functional, and operational system is delivered to the Government.

C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests for the equipment. Repair, replacement, and re-testing shall be accomplished at no additional cost to the Government.

1.15 WARRANTY

A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

1.16 INSTRUCTION

A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.

B. Furnish the services of competent and factory-trained instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be factory-trained in operating theory as well as practical operation and maintenance procedures.

C. A training schedule shall be developed and submitted by the Contractor and approved by the COR at least 30 days prior to the planned training.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

---END---

SECTION 26 05 13
MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of medium-voltage cables, indicated as cable or cables in this section, and medium-voltage cable splices and terminations.

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 medium-voltage cables.

D. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Manholes and ducts for medium-voltage cables.

E. Section 26 12 19, PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS: Medium-voltage cable terminations for use in pad-mounted, liquid-filled, medium-voltage transformers.

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. Factory Tests shall be required.

B. Factory Tests shall be in accordance with Paragraph, MANUFACTURED PRODUCTS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirement:

1. A representative sample of Medium-voltage cables from each lot shall be factory tested per NEMA WC 74 to ensure that there are no electrical defects in that specific lot of cable.

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. Submit the following data for approval:
      1) Complete electrical ratings.

2) Installation instructions.

2. Samples:
   a. After approval of submittal and prior to installation, Contractor shall furnish sample in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
3. Certifications:
   a. Factory Test Reports: Submit certified factory production test reports for approval.
   b. Field Test Reports: Submit field test reports for approval.
   c. Compatibility: Submit a certificate from the cable manufacturer that the splices and terminations are approved for use with the cable.
   d. Two weeks prior to final inspection, submit the following.
      1) Certification by the manufacturer that the cables, splices, and terminations conform to the requirements of the drawings and specifications.
      2) Certification by the Contractor that the cables, splices, and terminations have been properly installed and tested.
      3) Certification by the Contractor that each splice and each termination were completely installed in a single continuous work period by a single qualified worker without any overnight interruption.
4. Qualified Worker Approval:
   a. Qualified workers who install cables, splices, and terminations shall have a minimum of five years of experience splicing and terminating cables, including experience with the materials in the approved splices and terminations. Qualified workers who perform cable testing shall have a minimum of five year of experience performing electrical testing of medium-voltage cables, including the ability to understand, interpret test results and develop test report.
   b. Furnish satisfactory proof of such experience for each qualified worker who splices or terminates the cables.

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. American Society for Testing and Materials (ASTM):
   B3-13(2018)..... Standard Specification for Soft or Annealed Copper Wire

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   48-20 ..... Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated

Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV

386-16 ..... Separable Insulated Connector Systems for Power Distribution Systems above 600 V

400-12 ..... Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems

400.2-13 ..... Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF)

404-12 ..... Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500,000 V

D. National Electrical Manufacturers Association (NEMA):

WC 71-14 ..... Non-Shielded Cables Rated 2001-5000 Volts for Use in the Distribution of Electric Energy

WC 74-17 ..... 5-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy

E. National Fire Protection Association (NFPA):

70-23 ..... National Electrical Code (NEC)

F. Underwriters Laboratories (UL):

1072-06 ..... Medium-Voltage Power Cables

1.7 SHIPMENT AND STORAGE

A. Cable shall be shipped on reels such that it is protected against physical, mechanical and environmental damage. Each end of each length of cable shall be hermetically sealed with manufacturer's end caps and securely attached to the reel.

B. Cable stored and/or cut on site shall have the ends turned down, and sealed with cable manufacturer's standard cable end seals, or field-installed heat-shrink cable end seals.

PART 2 - PRODUCTS

2.1 CABLE

A. Cable shall be in accordance with ASTM, IEEE, NEC, NEMA and UL, and as shown on the drawings.

B. Single conductor stranded copper conforming to ASTM B3.

C. Voltage Rating:

1. 15,000 V cable shall be used on all distribution systems with voltages ranging from 5,000 V to 15,000 V.

D. Insulation:

1. Insulation level shall be 133%.
2. Types of insulation:

a. Cable type abbreviation, EPR: Ethylene propylene rubber insulation shall be thermosetting, light and heat stabilized.
b. Cable type abbreviation, XLP, XLPE, or TR-XLPE: cross-linked polyethylene insulation shall be thermosetting, light and heat stabilized, and chemically cross-linked.

E. Insulation shield shall be semi-conducting. Conductor shield shall be semi-conducting.
F. Insulation shall be wrapped with copper shielding tape, helically-applied over semi-conducting insulation shield.
G. Heavy duty, overall protective polyvinyl chloride jacket shall enclose every cable. The manufacturer's name, cable type and size, and other pertinent information shall be marked or molded clearly on the overall protective jacket.
H. Cable temperature ratings for continuous operation, emergency overload operation, and short circuit operation shall be not less than the NEC, NEMA WC 71, or NEMA WC 74 standard for the respective cable.

2.2 SPLICES AND TERMINATIONS

A. Materials shall be compatible with the cables being spliced and terminated, and shall be suitable for the prevailing environmental conditions.
B. In locations where moisture might be present, the splices shall be watertight. In manholes and pullboxes, the splices shall be submersible.
C. Splices:
1. Shall comply with IEEE 404. Include all components required for complete splice, with detailed instructions.

D. Terminations:
1. Shall comply with IEEE 48. Include shield ground strap for shielded cable terminations.
2. Class 3 terminations for outdoor use: Kit with stress cone and compression-type connector.
3. Load-break terminations for indoor and outdoor use: 200 A loadbreak premolded rubber elbow connectors with bushing inserts, suitable for submersible applications. Separable connectors shall comply with the requirements of IEEE 386, and shall be interchangeable between suppliers. Allow sufficient slack in medium-voltage cable, ground, and drain wires to permit elbow connectors to be moved to their respective parking stands.
4. Ground metallic cable shields with a device designed for that purpose, consisting of a solderless connector enclosed in watertight rubber housing covering the entire assembly.
5. Provide insulated cable supports to relieve any strain imposed by cable weight or movement. Ground cable supports to the grounding system.

2.3 FIREPROOFING TAPE

A. Fireproofing tape shall be flexible, non-corrosive, self-extinguishing, arcproof, and fireproof intumescent elastomer. Securing tape shall be glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (0.75 inch) wide.

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. Cable shall be installed in conduit above grade and duct bank below grade.

C. All cables of a feeder shall be pulled simultaneously.

D. Conductors of different systems (e.g., 5kV and 15kV) shall not be installed in the same raceway.

E. Splice the cables only in manholes and pullboxes.

F. Ground shields in accordance with Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

G. Cable maximum pull length, maximum pulling tension, and minimum bend radius shall conform with the recommendations of the manufacturer.

H. Use suitable lubricating compounds on the cables to prevent pulling damage. Provide compounds that are not injurious to the cable jacket and do not harden or become adhesive.

I. Seal the cable ends prior to pulling, to prevent the entry of moisture or lubricant.

3.2 PROTECTION DURING SPLICING OPERATIONS

A. Blowers shall be provided to force fresh air into manholes where free movement or circulation of air is obstructed. Waterproof protective coverings shall be available on the work site to provide protection against moisture while a splice is being made. Pumps shall be used to keep manholes dry during splicing operations. Under no conditions shall a splice or termination be made that exposes the interior of a cable to moisture. A manhole ring at least 150 mm (6 inches) above ground shall be used around the manhole entrance to keep surface water from entering the manhole. Unused ducts shall be plugged and water seepage through ducts in use shall be stopped before splicing.

3.3 PULLING CABLES IN DUCTS AND MANHOLES

A. Cables shall be pulled into ducts with equipment designed for this purpose, including power-driven winches, cable-feeding flexible tube guides, cable grips, pulling eyes, and lubricants. A sufficient number of qualified workers and equipment shall be employed to ensure the careful and proper installation of the cable.

B. Cable reels shall be set up at the side of the manhole opening and above the duct or hatch level, allowing cables to enter through the opening without reverse bending. Flexible tube guides shall

be installed through the opening in a manner that will prevent cables from rubbing on the edges of any structural member.

C. Cable shall be unreeled from the top of the reel. Pay-out shall be carefully controlled. Cables to be pulled shall be attached through a swivel to the main pulling wire by means of a suitable cable grip and pulling eye.

D. Woven-wire cable grips shall be used to grip the cable end when pulling small cables and short straight lengths of heavier cables.

E. Pulling eyes shall be attached to the cable conductors to prevent damage to the cable structure.

F. Cables shall be liberally coated with a suitable lubricant as they enter the tube guide or duct. Rollers, sheaves, or tube guides around which the cable is pulled shall conform to the minimum bending radius of the cable.

G. Cables shall be pulled into ducts at a reasonable speed. Cable pulling using a vehicle shall not be permitted. Pulling operations shall be stopped immediately at any indication of binding or obstruction, and shall not be resumed until the potential for damage to the cable is corrected. Sufficient slack shall be provided for free movement of cable due to expansion or contraction.

H. Splices in manholes shall be firmly supported on cable racks. Cable ends shall overlap at the ends of a section to provide sufficient undamaged cable for splicing.

I. Cables cut in the field shall have the cut ends immediately sealed to prevent entrance of moisture.

3.4 SPLICES AND TERMINATIONS

A. Install the materials as recommended by the manufacturer, including precautions pertaining to air temperature and humidity during installation.

B. Installation shall be executed by qualified person trained to perform medium-voltage equipment installations. Tools shall be as recommended or provided by the manufacturer. Installation shall comply with manufacturer's instructions.

C. Splices in manholes shall be located midway between cable racks on walls of manholes, and supported with cable arms at approximately the same elevation as the enclosing duct.

D. Where the Government determines that unsatisfactory splices and terminations have been installed, the Contractor shall replace the unsatisfactory splices and terminations with approved material at no additional cost to the Government.

3.5 FIREPROOFING

A. Cover all cable segments exposed in manholes and pullboxes with fireproofing tape.

B. Apply the tape in a single layer, wrapped in a half-lap manner, or as recommended by the manufacturer. Extend the tape not less than 25 mm (1 inch) into each duct.

C. At each end of a taped cable section, secure the fireproof tape in place with glass cloth tape.

3.6 CIRCUIT IDENTIFICATION OF FEEDERS

A. In each manhole and pullbox, install permanent identification tags on each circuit's cables to clearly designate the circuit identification and voltage. The tags shall be the embossed brass type, 40 mm (1.5 inches) in diameter and 40 mils thick. Attach tags with plastic ties. Position the tags so they will be easy and clear to read after the fireproofing tape is installed.

3.7 ACCEPTANCE CHECKS AND TESTS

A. General:
   1. Perform tests in accordance with the latest IEEE 400 and 400.2, manufacturer's recommendations, and as specified in this specification.
   2. Contractor shall make arrangements to have tests witnessed by the COR. Contractor shall proceed with tests only after obtaining approval from the COR.

B. Visual Inspection: Perform visual inspection prior to electrical tests.
   1. Inspect exposed sections of cables for physical damage.
   2. Inspect shield grounding, cable supports, splices, and terminations.
   3. Verify that visible cable bends meet manufacturer’s minimum bending radius requirement.
   4. Verify installation of fireproofing tape and identification tags.
   5. At the time of final acceptance, Contractor shall provide the COR visual field inspection notes, findings, and photographs detailing accessible inspection locations.

C. Electrical Tests - New Cables: Perform preparation and tests in order shown below:
   1. Preparation Prior to Testing: Splices and terminations applied to new cables shall be completed prior to testing. For renovation installation, ends of new cables intended to be spliced to existing service-aged cables shall be prepared (cut back) to allow testing without flashover or tracking. Cables shall not be connected to other equipment while under test.
   2. Perform Insulation-Resistance Test. Test all cables with respect to ground and adjacent cables. All adjacent cables shall be grounded during testing.
      a. Apply test voltage for a period sufficient to stabilize output voltage and insulation resistance measurement.
      b. Test data shall include megohm, applied test voltage, and leakage current readings.
      c. Further testing shall not continue unless the insulation resistance test results meet or exceed the values listed below. Test voltages and minimum acceptable resistance values shall be:

Voltage Class	Test Voltage	Min. Insulation Resistance
5kV	2,500 VDC	1,000 megohms
15kV	2,500 VDC	5,000 megohms
25kV	5,000 VDC	20,000 megohms
35kV	15,000 VDC	100,000 megohms

3. Perform Tan Delta test. Review test readings with the COR prior to proceeding with the Very Low Frequency (VLF) Withstand test
4. Perform Very Low Frequency (VLF) Withstand test. Utilize test voltages in accordance with IEEE 400.2.

D. Electrical Tests - Service-Aged Cables: Tests shall be performed for serviced-age cables before inter-connecting to new cables. Perform tests in order shown below:

1. Preparation Prior to Testing: Splices and terminations applied to cables shall be completed prior to testing. Ends of cables intended to be spliced to existing service-aged cables shall be prepared (cut back) to allow testing without flashover or tracking. Cables shall not be connected to other equipment while under test.
2. Perform Insulation-Resistance Test. Test all cables with respect to ground and adjacent cables. All adjacent cables shall be grounded during testing.
   a. Apply test voltage for a period sufficient to stabilize output voltage and insulation resistance measurement.
   b. Test data shall include megohm, applied test voltage, and leakage current readings.
   c. Further testing shall not continue unless the insulation resistance test results meet or exceed the values listed below. Test voltages and minimum acceptable resistance values shall be:

Voltage Class	Test Voltage	Min. Insulation Resistance
5kV	2,500 VDC	1,000 megohms
15kV	2,500 VDC	5,000 megohms
25kV	5,000 VDC	20,000 megohms
35kV	15,000 VDC	100,000 megohms

3. Perform Tan Delta test. Review test readings with the COR prior to proceeding with the VLF Withstand test.
4. Perform VLF Withstand test. Utilize test voltages in accordance with IEEE 400.2.

---END---

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

1.2 RELATED WORK

A. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-resistant rated construction.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

E. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Installation of conductors and cables in manholes and ducts.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit the following data for approval:
      1) Electrical ratings and insulation type for each conductor and cable.
      2) Splicing materials and pulling lubricant.
2. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.

B. American Society of Testing Material (ASTM):

D2301-10 ..... Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

D2304-18 ..... Test Method for Thermal Endurance of Rigid Electrical Insulating Materials

D3005-17 ..... Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Electrical Manufacturers Association (NEMA):

WC 70-21 ..... Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

D. National Fire Protection Association (NFPA):

70-23 ..... National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

44-18 ..... Thermoset-Insulated Wires and Cables

83-17 ..... Thermoplastic-Insulated Wires and Cables

467-13 ..... Grounding and Bonding Equipment

486A-486B-18 ..... Wire Connectors

486C-18 ..... Splicing Wire Connectors

486D-15 ..... Sealed Wire Connector Systems

486E-15 ..... Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-18 ..... 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. Conductors shall be copper.

C. Single Conductor:

1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.

2. No. 8 AWG and larger: Stranded.
3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

E. Conductor Color Code:
1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
   a. Solid color insulation or solid color coating.
   b. Stripes, bands, or hash marks of color specified.
   c. Color using 19 mm (0.75 inches) wide tape.
3. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
4. Conductors shall be color-coded as follows:

208/120 V	Phase
Black	A
Red	B
Blue	C
White	Neutral

5. Lighting circuit “switch legs”, and 3-way and 4-way switch “traveling wires,” shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COR.
6. Color code for isolated power system wiring shall be in accordance with the NEC.

2.2 SPLICES

A. Splices shall be in accordance with NEC and UL.
B. Above Ground Splices for No. 10 AWG and Smaller:
1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped conductors.
3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.

2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.
4. All bolts, nuts, and washers used with splices shall be zinc-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. 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 zinc-plated steel.

2.4 CONTROL WIRING

A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG, or as required by the control wiring equipment manufacturer.

B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.5 WIRE LUBRICATING COMPOUND

A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

B. Shall not be used on conductors for isolated power systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.

B. Install conductors in raceway systems.

C. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.

D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.

E. For conductors installed in vertical raceways, provide conductor support (also known as cable support), to counter gravity pull on conductor weight. Conductor support shall be split-wedge conductor support type. Prior to installing the conductor support plug, remove all pulling compound from conductors where they pass through the conductor support body. After installing the conductor support plug, tap the conductor support plug firmly in the conductor support body.

F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic "zip" ties.

G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.

H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.

I. Conductor Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
2. Use nonmetallic pull ropes.
3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. All conductors in a single conduit shall be pulled simultaneously.
5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

J. Number of conductors for branch circuits shall not exceed more than three branch circuits in any one conduit.

K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.2 INSTALLATION IN MANHOLES

A. Train the conductors around the manhole walls, but do not bend to a radius less than six times the overall conductor diameter.

3.3 SPLICE AND TERMINATION INSTALLATION

A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.

B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

3.4 CONDUCTOR IDENTIFICATION

A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where markings are covered by tape, apply tags to conductors, stating size and insulation type.

3.5 FEEDER CONDUCTOR IDENTIFICATION

A. In each interior pullbox and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

3.6 EXISTING CONDUCTORS

A. Unless specifically indicated on the plans, existing conductors shall not be reused.

3.7 CONTROL WIRING INSTALLATION

A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.

B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

3.8 CONTROL WIRING IDENTIFICATION

A. Install a permanent wire marker on each wire at each termination.

B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

C. Wire markers shall retain their markings after cleaning.

D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.10 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.

---END---

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.

B. “Grounding electrode system” refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.

C. The terms “connect” and “bond” are used interchangeably in this section and have the same meaning.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

D. Section 26 12 19, PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS: pad-mounted, liquid-filled, medium-voltage transformers.

E. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.

F. Section 26 41 00, FACILITY LIGHTNING PROTECTION: Lightning protection.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
2. Test Reports:
   a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COR.
3. Certifications:

a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Society for Testing and Materials (ASTM):

B1-13 ..... Standard Specification for Hard-Drawn Copper Wire
B3-13(R2018) ..... Standard Specification for Soft or Annealed Copper Wire
B8-11(R2017) ..... 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):

70-23 ..... National Electrical Code (NEC)
70E-21 ..... National Electrical Safety Code
99-21 ..... Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):

44-18 ..... Thermoset-Insulated Wires and Cables
83-17 ..... 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.

2.2 GROUND RODS

A. Steel or copper clad steel, 19 mm (0.75 inch) diameter by 3 M (10 feet) long.

B. Quantity of rods shall be as shown on the drawings, and as required to obtain the specified ground resistance.

2.3 CONCRETE ENCASED ELECTRODE

A. Concrete encased electrode shall be No. 4 AWG bare copper wire, installed per NEC.

2.4 GROUND CONNECTIONS

A. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.

B. Above Grade:

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-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 zinc-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 zinc-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 zinc-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 MEDIUM-VOLTAGE EQUIPMENT AND CIRCUITS

A. Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to the grounding electrode system.
B. Duct Banks and Manholes: Provide an insulated equipment grounding conductor in each duct containing medium-voltage conductors, sized per NEC except that minimum size shall be No. 2 AWG. Bond the equipment grounding conductors to the switchgear ground bus, to all manhole grounding provisions and hardware, to the cable shield grounding provisions of medium-voltage cable splices and terminations, and to equipment enclosures.
C. Pad-Mounted Transformers:
   1. Provide a driven ground rod and bond with a grounding electrode conductor to the transformer grounding pad.
   2. Ground the secondary neutral.
D. Lightning Arresters: Connect lightning arresters to the equipment ground bus or ground rods as applicable.

3.4 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
B. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):
   1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.
   2. Provide a supplemental ground electrode as shown on the drawings and bond to the grounding electrode system.
C. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers, Engine-Generators, Automatic Transfer Switches, and other electrical equipment:

1. Connect the equipment grounding conductors to the ground bus.
2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

D. Transformers:
1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.

3.5 RACEWAY

A. Conduit Systems:
1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and all branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

D. Wireway Systems:
1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.

4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

H. Raised Floors: Provide bonding for all raised floor components as shown on the drawings.

I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG, installed in rigid metal conduit.

3.6 OUTDOOR METALLIC FENCES AROUND ELECTRICAL EQUIPMENT

A. Fences shall be grounded with a ground rod at each fixed gate post and at each corner post.

B. Drive ground rods until the top is 300 mm (12 inches) below grade. Attach a No. 4 AWG copper conductor by exothermic weld to the ground rods, and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 300 mm (12 inches) of fence mesh and fasten by two approved bronze compression fittings, one to bond the wire to post and the other to bond the wire to fence. Each gate section shall be bonded to its gatepost by a 3 mm x 25 mm (0.375 inch x 1 inch) flexible, braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.

3.7 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.

3.8 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

B. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

3.9 LIGHTNING PROTECTION SYSTEM

A. Bond the lightning protection system to the electrical grounding electrode system.

3.10 MAIN ELECTRICAL ROOM GROUNDING

A. Provide ground bus bar and mounting hardware at each main electrical room where incoming feeders are terminated, as shown on the drawings. Connect to pigtail extensions of the building grounding ring, as shown on the drawings.

3.11 EXTERIOR LIGHT POLES

A. Provide 6.1 M (20 feet) of No. 4 AWG bare copper coiled at bottom of pole base excavation prior to pour, plus additional un-spliced length in and above foundation as required to reach pole ground stud.

3.12 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.

3.13 GROUND ROD INSTALLATION

A. For outdoor installations, drive each rod vertically in the earth, until top of rod is 610 mm (24 inches) below final grade.

B. For indoor installations, leave 100 mm (4 inches) of each rod exposed.

C. Where buried or permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.

D. Where rock or impenetrable soil prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified ground resistance.

3.14 ACCEPTANCE CHECKS AND TESTS

A. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized or connected to the electric utility company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.

B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Below-grade connections shall be visually inspected by the COR prior to backfilling. The Contractor shall notify the COR 24 hours before the connections are ready for inspection.

---END---

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets.

B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.

C. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

D. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.

E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

F. 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.

G. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground conduits.

H. 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):

S100-16 ..... North American Specification for the Design of Cold-Formed Steel Structural Members

C. National Electrical Manufacturers Association (NEMA):

C80.1-20 ..... Electrical Rigid Steel Conduit

C80.3-20 ..... Steel Electrical Metal Tubing

C80.6-18 ..... Electrical Intermediate Metal Conduit

FB1-14 ..... Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

FB2.10-21 ..... Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate Metallic Conduit, and Electrical Metallic Tubing)

FB2.20-21 ..... Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable

TC-2-20 ..... Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

TC-3-21 ..... PVC Fittings for Use with Rigid PVC Conduit and Tubing

D. National Fire Protection Association (NFPA):

70-23 ..... 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

1242-06 ..... Electrical Intermediate Metal Conduit - Steel

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 13 mm (0.5-inch) unless otherwise shown. Where permitted by the NEC, 13 mm (0.5-inch) flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Size: In accordance with the NEC, but not less than 13 mm (0.5-inch).
2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and NEMA C80.1.
3. Rigid Intermediate Steel Conduit (IMC): Shall conform to UL 1242 and NEMA C80.6.
4. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and NEMA C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 V or less.
5. Flexible Metal Conduit: Shall conform to UL 1.
6. Liquid-tight Flexible Metal Conduit: Shall conform to UL 360.
7. Direct Burial Plastic Conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
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. Erickson (Union-Type) and Set Screw Type Couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
   f. Sealing Fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes

with blank cover plates having the same finishes as that of other electrical plates in the room.

2. Electrical Metallic Tubing Fittings:
   a. Fittings and conduit bodies shall meet the requirements of UL 514B, NEMA C80.3, and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. 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.
   e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Flexible Metal Conduit Fittings:
   a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   b. Clamp-type, with insulated throat.
5. 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.
6. Direct Burial Plastic Conduit Fittings: Fittings shall meet the requirements of UL 514C and NEMA TC3.
7. 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.
8. Expansion and Deflection Couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate a 19 mm (0.75-inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
   c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
   d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:
   1. Parts and Hardware: Zinc-coat or provide equivalent corrosion protection.

2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
3. Multiple Conduit (Trapeze) Hangers: Not less than 38 mm x 38 mm (1.5 x 1.5 inches), 12-gauge steel, cold-formed, lipped channels; with not less than 9 mm (0.375-inch) diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:
1. Comply with UL-50 and UL-514A.
2. Rustproof cast metal where required by the NEC or shown on drawings.
3. Sheet Metal Boxes: Galvanized steel, except where shown on drawings.

F. Metal Wireways: Equip with hinged covers, except as shown on drawings. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:
1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COR prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except when permitted by the COR where working space is limited.

B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal the gap around conduit to render it watertight, as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

A. In accordance with NEC, NEMA, UL, as shown on drawings, and as specified herein.

B. Raceway systems used for Essential Electrical Systems (EES) shall be entirely independent of other raceway systems.

C. Install conduit as follows:
1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.

4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
5. Cut conduits square, ream, remove burrs, and draw up tight.
6. Independently support conduit at 2.4 M (8 feet) on centers with specified materials and as shown on drawings.
7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
9. Close ends of empty conduits with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
10. Conduit installations under fume and vent hoods are prohibited.
11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
12. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
13. Conduit bodies shall only be used for changes in direction, and shall not contain splices.

D. Conduit Bends:
1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown on drawings.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted and approved by the COR.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:
1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only:
   a. Where shown on the structural drawings.
   b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
   a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.

b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.

c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (0.75-inch) of concrete around the conduits.

5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for Conductors Above 600 V: Rigid steel. Mixing different types of conduits in the same system is prohibited.
2. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 1.8 M (6 feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.
6. For conduits running through metal studs, limit field cut holes to no more than 70% of web depth. Spacing between holes shall be at least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.

B. Conduit for Conductors Above 600 V: Rigid steel. Mixing different types of conduits in the system is prohibited.

C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the system is prohibited.

D. Align and run conduit parallel or perpendicular to the building lines.

E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

F. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals.

G. Surface Metal Raceways: Use only where shown on drawings.

H. Painting:

1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (2 inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6 M (20 feet) intervals in between.

3.5 DIRECT BURIAL INSTALLATION

Refer to Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

3.6 HAZARDOUS LOCATIONS

A. Use rigid steel conduit only.

B. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.7 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.

3.8 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.

3.9 EXPANSION JOINTS

A. Conduits 75 mm (3 inch) and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inch) with junction boxes on both sides of the expansion joint. Connect flexible metal conduits to junction boxes with sufficient slack to produce a 125 mm (5 inch) vertical drop midway between the ends of the flexible metal conduit. Flexible metal conduit shall have a green insulated copper bonding jumper installed. In lieu of this flexible metal conduit, expansion and deflection couplings as specified above are acceptable.

C. Install expansion and deflection couplings where shown.

3.10 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.

3.11 BOX INSTALLATION

A. Boxes for Concealed Conduits:

1. Flush-mounted.
2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.

C. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.

D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.

F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.

H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "ELECTRICAL PB No. 1."

I. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -

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 to form a complete underground electrical raceway system.

B. The terms “duct” and “conduit” are used interchangeably in this section.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS: Sealing of conduit penetrations.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 31 20 00, EARTH MOVING Section 31 20 11: Trenching, backfill, and compaction.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Coordinate layout and installation of ducts with final arrangement of other utilities, site grading, and surface features.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit information on ducts, and hardware.
   c. Proposed deviations from the drawings shall be clearly marked on the submittals. If it is necessary to locate duct banks at locations other than shown on the drawings, show the proposed locations accurately on scaled site drawings, and submit to the COR for approval prior to construction.
2. Certifications: Two weeks prior to the final inspection, submit the following.
   a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the materials have been properly installed, connected, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Concrete Institute (ACI):
Building Code Requirements for Structural Concrete
318-19/318M-19..... Building Code Requirements for Structural Concrete & Commentary
MNL-66-20..... ACI Detailing Manual

C. American National Standards Institute (ANSI):
77-17 ..... Underground Enclosure Integrity

D. American Society for Testing and Materials (ASTM):
C478/C478M-20..... Standard Specification for Precast Reinforced Concrete Manhole Sections
C858-19..... Underground Precast Concrete Utility Structures
C990/C990M-09..... Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.

E. National Electrical Manufacturers Association (NEMA):
TC 2-20..... Electrical Polyvinyl Chloride (PVC) Conduit
TC 3-21..... Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit And Tubing
TC 6 & 8-20 ..... Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installations
TC 9-20..... Fittings For Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installation

F. National Fire Protection Association (NFPA):
70-23 ..... National Electrical Code (NEC)
70E-21 ..... 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 DUCTS

A. Number and sizes shall be as shown on the drawings.

B. Ducts (concrete-encased):
   1. Plastic Duct:
      a. UL 651 and 651A Schedule 40 PVC conduit.
      b. Duct shall be suitable for use with 90˚ C (194˚ F) rated conductors.
   2. Conduit Spacers: Prefabricated plastic.
C. Ducts (direct-burial):
   1. Plastic duct:
      a. Schedule 40 PVC or HDPE conduit.
      b. Duct shall be suitable for use with 75˚ C (167˚ F) rated conductors.
   2. Rigid metal conduit: UL 6 and NEMA RN1 galvanized rigid metal, half-lap wrapped with 10 mil PVC tape.

2.2 GROUNDING

A. Ground Rods and Ground Wire: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.3 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.

2.4 PULL ROPE FOR SPARE DUCTS

A. Plastic with 890 N (200 lb) minimum tensile strength.

PART 3 - EXECUTION

3.1 TRENCHING

A. Refer to Section 31 20 00, EARTH MOVING 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. Avoid pitching the ducts toward buildings wherever possible.
   3. The walls of the trench may be used to form the side walls of the duct bank, provided that the soil is self-supporting and that the concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.
   4. After the concrete-encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, and appropriate warning tape installed.

F. Individual conduits to be installed under existing paved areas and roads that cannot be disturbed shall be jacked into place using rigid metal conduit, or bored using plastic utilities duct or PVC conduit, as approved by the COR.

3.2 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 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. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.
12. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
13. 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.

14. 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.
15. 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.
16. 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 wall penetrations, install reinforcing steel bars at the top and bottom of each concrete envelope to provide protection against vertical shearing.
6. Install reinforcing steel bars at the top and bottom of each concrete envelope of all ducts underneath roadways and parking areas.
7. Where new ducts and concrete envelopes are to be joined to existing manholes, pullboxes, ducts, and concrete envelopes, make the joints with the proper fittings and fabricate the concrete envelopes to ensure smooth durable transitions.
8. Duct joints in concrete may be placed side by side horizontally, but shall be staggered at least 150 mm (6 inches) vertically.
9. Pour each run of concrete envelope between terminations in one continuous pour. If more than one pour is necessary, terminate each pour in a vertical plane and install 19 mm (0.75

inch) reinforcing rod dowels extending 450 mm (18 inches) into concrete on both sides of joint near corners of envelope.

10. Pour concrete so that open spaces are uniformly filled. Do not agitate with power equipment unless approved by COR.

C. Direct-Burial Ducts:

1. Install direct-burial ducts only where shown on the drawings. Provide direct-burial ducts only for low-voltage power and lighting branch circuits.
2. Tops of 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.
3. Do not kink the ducts. Compaction shall not deform the ducts.

D. Connections to Existing Manholes: For duct connections to existing manholes, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

E. Connections to Existing Ducts: Where connections to existing ducts are indicated, excavate around the ducts as necessary. Cut off the ducts and remove loose concrete from inside before installing new ducts. Provide a reinforced-concrete collar, poured monolithically with the new ducts, to take the shear at the joint of the duct banks.

F. Partially-Completed Ducts: During construction, wherever a construction joint is necessary in a duct bank, prevent debris such as mud and dirt from entering ducts by providing suitable plugs. Fit concrete envelope of a partially completed ducts with reinforcing steel extending a minimum of 600 mm (2 feet) back into the envelope and a minimum of 600 mm (2 feet) beyond the end of the envelope. Provide one No. 4 bar in each corner, 75 mm (3 inches) from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 300 mm (12 inches) apart. Restrain reinforcing assembly from moving during pouring of concrete.

3.4 ACCEPTANCE CHECKS AND TESTS

A. Duct Testing and Cleaning:

1. Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct, and to test for out-of-round conditions.

2. The mandrel shall be not less than 300 mm (12 inches) long, and shall have a diameter not less than 13 mm (0.5 inch) less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
3. If testing reveals obstructions or out-of-round conditions, the Contractor shall replace affected section(s) of duct and retest to the satisfaction of the COR.
4. Mandrel pulls shall be witnessed by the COR.

---END---

SECTION 26 05 73
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the overcurrent protective device coordination study, related calculations and analysis, indicated as the study in this section.

B. A short-circuit and selective coordination study, and arc flash calculations and analysis shall be prepared for the electrical overcurrent devices to be installed under this project.

C. The study shall present a well-coordinated time-current analysis of each overcurrent protective device from the individual device up to the utility source and the on-site generator sources.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.

B. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. The study shall be prepared by the equipment manufacturer, and performed by the equipment manufacturer’s licensed electrical engineer.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Product data on the software program to be used for the study. Software shall be in mainstream use in the industry, shall provide device settings and ratings, and shall show selective coordination by time-current drawings.
2. Complete study as described in paragraph 1.6. Submittal of the study shall be well-coordinated with submittals of the shop drawings for equipment in related specification sections.
3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the Contractor that the overcurrent protective devices have been set in accordance with the approved study.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. Institute of Electrical and Electronics Engineers (IEEE):

241-90 ..... Recommended Practice Electrical Systems in Commercial Buildings

242-01 ..... Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

399-97 ..... Recommended Practice for Industrial and Commercial Power Systems Analysis

1584-18 ..... Performing Arc-Flash Hazards Calculations

C. National Fire Protection Association (NFPA):

70-23 ..... National Electrical Code (NEC)

70E-21 ..... Standard for Electrical Safety in the Workplace

99-21 ..... Health Care Facilities Code

1.6 STUDY REQUIREMENTS

A. The study shall be in accordance with IEEE and NFPA standards.

B. The study shall include one line diagram, short-circuit and ground fault analysis, protective coordination plots for all overcurrent protective devices, and arc flash calculations and analysis.

C. One Line Diagram:

1. Show all electrical equipment and wiring to be protected by the overcurrent devices.
2. Show the following specific information:
   a. Calculated fault impedance, X/R ratios, and short-circuit values at each feeder and branch circuit bus.
   b. Relay, circuit breaker, and fuse ratings.
   c. Generator kW/kVA and transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
   d. Voltage at each bus.
   e. Identification of each bus, matching the identification on the drawings.
   f. Conduit, conductor, and busway material, size, length, and X/R ratios.

D. Short-Circuit Study:

1. The study shall be performed using computer software designed for this purpose. Pertinent data and the rationale employed in developing the calculations shall be described in the introductory remarks of the study.
2. Calculate the fault impedance to determine the available short-circuit and ground fault currents at each bus. Incorporate applicable motor and/or generator contribution in determining the momentary and interrupting ratings of the overcurrent protective devices.
3. Present the results of the short-circuit study in a table. Include the following:
   a. Device identification.
   b. Operating voltage.

c. Overcurrent protective device type and rating.
d. Calculated short-circuit current.

E. Coordination Study:
1. Prepare the coordination curves to determine the required settings of overcurrent protective devices to demonstrate selective coordination. Graphically illustrate on log-log paper that adequate time separation exists between devices, including the utility company upstream device if applicable. Plot the specific time-current characteristics of each overcurrent protective device in such a manner that all devices are clearly depicted.
2. The following specific information shall also be shown on the coordination curves:
a. Device identification.
b. Potential transformer and current transformer ratios.
c. Three-phase and single-phase ANSI damage points or curves for each cable, transformer, or generator.
d. Applicable circuit breaker or protective relay characteristic curves.
e. No-damage, melting, and clearing curves for fuses.
f. Transformer in-rush points.
3. Develop a table to summarize the settings selected for the overcurrent protective devices. Include the following in the table:
a. Device identification.
b. Protective relay or circuit breaker potential and current transformer ratios, sensor rating, and available and suggested pickup and delay settings for each available trip characteristic.
c. Fuse rating and type.

F. Arc Flash Calculations and Analysis:
1. Arc flash warning labels shall comply with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
2. Arc flash calculations shall be based on actual over-current protective device clearing time. Maximum clearing time shall be in accordance with IEEE 1584.
3. Arc flash analysis shall be based on the lowest clearing time setting of the over-current protective device to minimize the incident energy level without compromising selective coordination.
4. Arc flash boundary and available arc flash incident energy at the corresponding working distance shall be calculated for all electrical power distribution equipment specified in the project, and as shown on the drawings.
5. Required arc-rated clothing and other PPE shall be selected and specified in accordance with NFPA 70E.

1.7 ANALYSIS

A. Analyze the short-circuit calculations, and highlight any equipment determined to be underrated as specified. Propose solutions to effectively protect the underrated equipment.

1.8 ADJUSTMENTS, SETTINGS, AND MODIFICATIONS

A. Final field settings and minor modifications of the overcurrent protective devices shall be made to conform with the study, without additional cost to the Government.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

---END---

SECTION 26 09 23
LIGHTING CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of the lighting controls.

1.2 RELATED WORK

A. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Interface of lighting controls with HVAC control systems.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

E. Section 26 24 16, PANELBOARDS: Panelboard enclosure and interior bussing used for lighting control panels.

F. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

G. Section 26 51 00, INTERIOR LIGHTING: Luminaire ballast and drivers used in control of lighting systems.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit the following information for each type of lighting controls.
   b. Material and construction details.
   c. Physical dimensions and description.
   d. Wiring schematic and connection diagram.
   e. Installation details.
2. Manuals:
   a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.

a. Certification by the Contractor that the lighting control systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. National Electrical Manufacturer's Association (NEMA):

C136.10-17 ..... American National Standard for Roadway and Area Lighting Equipment—Locking-Type Photocontrol Devices and Mating Receptacles—Physical and Electrical Interchangeability and Testing

ICS-1-00(R2015)..... Standard for Industrial Control and Systems General Requirements

ICS-2-00(R2020)..... Standard for Industrial Control and Systems Controllers, Contractors, and Overload Relays Rated 600 Volts

ICS-6-93(R2016)..... Standard for Industrial Controls and Systems Enclosures

C. National Fire Protection Association (NFPA):

70-23 ..... National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):

20-18 ..... Standard for General-Use Snap Switches

98-16 ..... Enclosed and Dead-Front Switches

773-16 ..... Standard for Plug-In Locking Type Photocontrols for Use with Area Lighting

773A-16 ..... Nonindustrial Photoelectric Switches for Lighting Control

916-15 ..... Standard for Energy Management Equipment

917-06 ..... Clock Operated Switches

924-16 ..... Emergency Lighting and Power Equipment

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

A. Solid state, with SPST dry contacts rated for 1800 VA tungsten or 1000 VA inductive, complying with UL 773A.

1. Light-Level Monitoring Range: 16.14 to 108 lx (1.5 to 10 fc), with adjustable turn-on and turn-off levels.

2. Time Delay: 15-second minimum.

3. Surge Protection: Metal-oxide varistor.
4. Mounting: Twist lock, with base-and-stem mounting or stem-and-swivel mounting accessories as required.

2.2 CEILING-MOUNTED PHOTOELECTRIC SWITCHES

A. Solid-state, light-level sensor unit, with separate relay unit.
1. Sensor Output: Contacts rated to operate the associated relay. Sensor shall be powered from the relay unit.
2. Relay Unit: Dry contacts rated for 20A ballast load at 120 volt and 277 volt, for 13A tungsten at 120 volt, and for 1 hp at 120 volt.
3. Monitoring Range: 108 to 2152 lx (10 to 200 fc), with an adjustment for turn-on and turn-off levels.
4. Time Delay: Adjustable from 5 to 300 seconds, with deadband adjustment.
5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

2.3 SKYLIGHT PHOTOELECTRIC SENSORS

A. Solid-state, light-level sensor; housed in a threaded, plastic fitting for mounting under skylight; with separate relay unit.
1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
2. Relay Unit: Dry contacts rated for 20A ballast load at 120 volt and 277 volt, for 13A tungsten at 120 volt, and for 1 hp at 120 volt.
3. Monitoring Range: 10,800 to 108,000 lx (1000 to 10,000 fc), with an adjustment for turn-on and turn-off levels.
4. Time Delay: Adjustable from 5 to 300 seconds, with deadband adjustment.
5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

2.4 INDOOR OCCUPANCY SENSORS

A. Wall- or ceiling-mounting, solid-state units with a power supply and relay unit, suitable for the environmental conditions in which installed.
1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a 1 to 15 minute adjustable time delay for turning lights off.
2. Sensor Output: Contacts rated to operate the connected relay. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20A ballast load at 120 volt and 277 volt, for 13A tungsten at 120 volt, and for 1 hp at 120 volt.
4. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Manual/automatic selector switch.
8. Automatic Light-Level Sensor: Adjustable from 21.5 to 2152 lx (2 to 200 fc); keep lighting off when selected lighting level is present.
9. Faceplate for Wall-Switch Replacement Type: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

B. Dual-technology Type: Ceiling mounting; combination PIR and ultrasonic detection methods, field-selectable.
1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 150 mm (6-inch) minimum movement of any portion of a human body that presents a target of not less than 232 sq. cm (36 sq. in), and detect a person of average size and weight moving not less than 305 mm (12 inches) in either a horizontal or a vertical manner at an approximate speed of 305 mm/s (12 inches/s).

C. Detection Coverage: Shall be sufficient to provide coverage as required by sensor locations shown on drawing.

2.5 INDOOR VACANCY SENSOR SWITCH

A. Wall mounting, solid-state units with integral sensor and switch.
1. Operation: Manually turn lights on with switch and sensor detects vacancy to turn lights off.
2. Switch Rating: 120/277 volt, 1200 watts at 277 volt, 800 watts at 120 volt unit.
3. Mounting:
   a. Sensor: Suitable for mounting in a standard switch box.
   b. Time-Delay and Sensitivity Adjustments: Integral with switch and accessible for reprogramming without removing switch.
4. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
5. Switch: Manual operation to turn lights on and override lights off.
6. Faceplate: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, manufacturer's instructions, as shown on the drawings, and as specified.

B. Aim outdoor photoelectric sensor according to manufacturer's recommendations. Set adjustable window slide for 1 footcandle turn-on.

C. Aiming for wall-mounted and ceiling-mounted motion sensor switches shall be per manufacturer's recommendations.

D. Set occupancy sensor "on" duration to 15 minutes.

E. Locate photoelectric sensors as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for the available light level at the typical work plane for that area.

F. Label time switches and contactors with a unique designation.

G. Program lighting control panels per schedule on drawings.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations.

B. Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.

C. Test for full range of dimming ballast and dimming controls capability. Observe for visually detectable flicker over full dimming range.

D. Test occupancy sensors for proper operation. Observe for light control over entire area being covered.

3.3 FOLLOW-UP VERIFICATION

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting control devices are in good operating condition and properly performing the intended function in the presence of COR.

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SECTION 26 12 19
PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the pad-mounted, liquid-filled, medium-voltage transformers, indicated as transformers in this section.

1.2 RELATED WORK

A. Section 03 30 00, CAST-IN-PLACE CONCRETE: Requirements for concrete equipment pads.

B. Section 09 06 00, SCHEDULE FOR FINISHES: Finishes for electrical equipment.

C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

D. Section 26 05 13, MEDIUM-VOLTAGE CABLES: Medium-voltage cables.

E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground currents.

F. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Manholes, pull-boxes, and ducts for underground raceway systems.

G. Section 26 05 73, OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY: Short circuit and coordination study, and requirements for a coordinated electrical system.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

A. Factory Tests shall be required.

B. Factory Tests shall be in accordance with Paragraph, MANUFACTURED PRODUCTS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirement:

1. Transformers shall be thoroughly tested at the factory to ensure that there are no electrical or mechanical defects. Tests shall be conducted as per IEEE Standards. Factory tests shall be certified. The following tests shall be performed:
   a. Perform insulation-resistance tests, winding-to-winding and each winding-to-ground.
   b. Perform turns-ratio tests at all tap positions.

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, nameplate data, impedance, outline drawing with dimensions and front, top, and side views, weight, mounting details, decibel rating, termination information, temperature rise, no-load and full-load losses, regulation, overcurrent protection, connection diagrams, and accessories.
c. Complete nameplate data, including manufacturer's name and catalog number.

2. Manuals:
a. When submitting the shop drawings, submit companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
1) Identify terminals on wiring diagrams to facilitate installation, maintenance, and operation.
2) Indicate on wiring diagrams the internal wiring for each piece of equipment and interconnections between the pieces of equipment.
3) Approvals will be based on complete submissions of manuals, together with shop drawings.
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) Update the manual to include any information necessitated by shop drawing approval.
2) Show all terminal identification.
3) Include information for testing, repair, troubleshooting, assembly, disassembly, and recommended maintenance intervals.
4) Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.

B. Certifications:
1. Two weeks prior to the final inspection, submit the following certifications.
a. Certification by the manufacturer that the transformers conform to the requirements of the drawings and specifications.
b. Certification by the Contractor that the transformers have been properly installed, connected, 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. American Society for Testing and Materials (ASTM):

D3487-16 ..... Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus

C. Institute of Electrical and Electronic Engineers (IEEE):

48-20 ..... Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5kV Through 765kV or Extruded Insulation Rated 2.5kV Through 500kV

386-16 ..... Separable Insulated Connector Systems for Power Distribution Systems Above 600 V

592-18 ..... Insulation Shields on Medium-Voltage (15 kV - 35 kV) Cable Joints and Separable Connectors

C2-17..... National Electrical Safety Code

C37.42-16..... Specifications for High-Voltage (>1000 V) Fuses and Accessories

C57.12.00-21 ..... Liquid-Immersed Distribution, Power and Regulating Transformers

C57.12.10-17 ..... Liquid-Immersed Power Transformers

C57.12.25-90 ..... Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution-Transformers with Separable Insulated High Voltage Connectors; High Voltage, 34500 Grd Y/19920 Volts and Below; Low-Voltage 240/120 Volts; 167 kVA and Smaller Requirements

C57.12.28-14 ..... Pad-Mounted Equipment - Enclosure Integrity

C57.12.29-14 ..... Pad-Mounted Equipment – Enclosure Integrity for Coastal Environments

C57.12.34-15 ..... Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers, 5 MVA and Smaller; High Voltage, 34.5 kV Nominal System Voltage and Below; Low Voltage, 15kV Nominal System Voltage and Below

C57.12.90-21 ..... Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers

C62.11-20..... Metal-Oxide Surge Arresters for AC Power Circuits

D. International Code Council (ICC):
IBC-21 ..... International Building Code

E. National Electrical Manufacturers Association (NEMA):
TR 1-13(R2019) ..... Transformers, Regulators, and Reactors

F. National Fire Protection Association (NFPA):
70-23 ..... National Electrical Code (NEC)

G. Underwriters Laboratories Inc. (UL):
467-13 ..... Grounding and Bonding Equipment

H. United States Department of Energy (DOE):
10 CFR Part 431 ..... Energy Efficiency Program for Certain Commercial and Industrial Equipment

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Transformers shall be in accordance with ASTM, IEEE, NFPA, UL, as shown on the drawings, and as specified herein. Each transformer shall be assembled as an integral unit by a single manufacturer.

B. Transformers shall be complete, outdoor type, continuous duty, integral assembly, grounded, tamper-resistant, and with liquid-immersed windings.

C. Ratings shall not be less than shown on the drawings.

D. Completely fabricate transformers at the factory so that only the external cable connections are required at the project site.

E. Thoroughly clean, phosphatize, and finish all the metal surfaces at the factory with a rust-resistant primer and dark green enamel finish coat, except where a different color is specified in Section 09 06 00, SCHEDULE FOR FINISHES. All surfaces of the transformer that will be in contact with the concrete pad shall be treated with corrosion-resistant compounds and epoxy resin or a rubberized sealing compound.

2.2 COMPARTMENTS

A. Construction:

1. Enclosures shall be weatherproof and in accordance with IEEE C57.12.28.
2. The medium- and low-voltage compartments shall be separated with a steel barrier that extends the full height and depth of the compartments.
3. The compartments shall be constructed of sheet steel (gauge to meet ANSI requirements) with bracing and with reinforcing gussets using jig welds to assure rectangular rigidity.
4. All bolts, nuts, and washers shall be zinc-plated steel.
5. Sufficient space shall be provided for equipment, cabling, and terminations within the compartments.

6. Affix transformer nameplate permanently within the low-voltage compartment. Voltage and kVA rating, connection configuration, impedance, date of manufacture, and serial number shall be shown on the nameplate.

B. Doors:

1. Provide a separate door for each compartment with provisions for a single padlock to secure all doors. Provide each compartment door with open-position doorstops and corrosion-resistant tamperproof hinges welded in place. The medium-voltage compartment door shall be mechanically prevented from opening unless the low-voltage compartment door is open.
2. The secondary compartment door shall have a one-piece steel handle and incorporate three-point locking mechanisms.

2.3 BIL RATING

A. 15 kV class equipment shall have a minimum 95 kV BIL rating.

2.4 TRANSFORMER FUSE ASSEMBLY

A. The primary fuse assembly shall be a combination of externally replaceable Bay-O-Net liquid-immersed fuses in series with liquid-immersed current-limiting fuses.

2.5 PRIMARY CONNECTIONS

A. Primary connections shall be 200 A dead-front loadbreak wells and inserts for cable sizes shown on the drawings.

B. Surge Arresters: Distribution class, one for each primary phase, complying with IEEE C62.11, supported from tank wall.

2.6 MEDIUM-VOLTAGE SWITCH

A. The transformer primary disconnect switch shall be an oil-immersed, internal, gang-operated, load-interrupter type, rated at ampacity and system voltage as shown on the drawings, with a minimum momentary withstand rating of not less than the calculated available fault current shown on the drawings.

B. For radial feeds, switch shall be a two-position, on-off, manual switch located in the medium-voltage compartment and hot-stick-operated.

2.7 MEDIUM-VOLTAGE TERMINATIONS

A. Terminate the medium-voltage cables in the primary compartment with 200 A loadbreak premolded rubber elbow connectors, suitable for submersible applications. Elbow connectors shall have a semi-conductive shield material covering the housing. The separable connector system shall include the loadbreak elbow, the bushing insert, and the bushing well. Separable connectors shall comply with the requirements of IEEE 386, and shall be interchangeable between suppliers. Allow sufficient slack in medium-voltage cable, ground, and drain wires to permit elbow connectors to be moved to their respective parking stands.

B. Ground metallic cable shield with a cable shield grounding adapter, consisting of a solderless connector enclosed in watertight rubber housing covering the entire assembly, bleeder wire, and ground braid.

2.8 LOW-VOLTAGE EQUIPMENT

A. Mount the low-voltage bushings, and hot stick in the low-voltage compartment.

B. The low-voltage leads shall be brought out of the tank by epoxy pressure tight bushings, and shall be standard arrangement.

C. Tin-plate the low-voltage neutral terminal and isolate from the transformer tank. Provide a removable ground strap sized in accordance with the NEC and connect between the secondary neutral and ground pad.

2.9 TRANSFORMERS

A. Transformer ratings shall be as shown on drawings. kVA ratings shown on the drawings are for continuous duty without the use of cooling fans.

B. Temperature rises shall not exceed the NEMA TR 1 of 65˚ C (149˚ F) by resistance.

C. Transformer insulating material shall be less flammable, edible-seed-oil based, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300˚ C (600˚ F) when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

D. Transformer impedance shall be not less than 4-1/2% for sizes 150 kVA and larger. Impedance shall be as shown on the drawings.

E. Sound levels shall conform to NEMA TR 1 standards.

F. Primary and Secondary Windings for Three-Phase Transformers:

1. Primary windings shall be delta-connected.
2. Secondary windings shall be wye-connected, except where otherwise indicated on the drawings. Provide isolated neutral bushings for secondary wye-connected transformers.
3. Secondary leads shall be brought out through pressure-tight epoxy bushings.

G. Primary windings shall have four 2-1/2% full-capacity voltage taps; two taps above and two taps below rated voltage.

H. Core and Coil Assemblies:

1. Cores shall be grain-oriented, non-aging, silicon steel to minimize losses.
2. Core and coil assemblies shall be rigidly braced to withstand the stresses caused by rough handling during shipment, and stresses caused by any possible short-circuit currents.
3. Coils shall be continuous-winding type without splices except for taps. Material shall be copper.
4. Coil and core losses shall be optimum for efficient operation.
5. Primary, secondary, and tap connections shall be brazed or pressure type.
6. Provide end fillers or tie-downs for coil windings.

I. The transformer tank, cover, and radiator gauge thickness shall not be less than that required by ANSI.

J. Accessories:

1. Provide standard NEMA features, accessories, and the following:
   a. No-load tap changer. Provide warning sign.
   b. Lifting, pulling, and jacking facilities.
   c. Globe-type valve for oil filtering and draining, including sampling device.
   d. Pressure relief valve.
   e. Liquid level gauge and filling plug.
   f. A grounding pad in the medium- and low-voltage compartments.
   g. A diagrammatic nameplate.
   h. Dial-type liquid thermometer with a maximum reading pointer and an external reset.
   i. Hot stick. Securely fasten hot stick within low-voltage compartment.
2. The accessories shall be made accessible within the compartments without disassembling trims and covers.

K. Transformers shall meet the energy conservation standards for transformers per the United States Department of Energy 10 CFR Part 431.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install transformers outdoors, as shown on the drawings, in accordance with the NEC, and as recommended by the manufacturer.

B. Anchor transformers 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. Mount transformers on concrete slab. Unless otherwise indicated, the slab shall be at least 200 mm (8 inches) thick, reinforced with a 150 by 150 mm (6 by 6 inches) No. 6 mesh placed uniformly 100 mm (4 inches) from the top of the slab. Slab shall be placed on a 150 mm (6 inches) thick, well-compacted gravel base. The top of the concrete slab shall be approximately 100 mm (4 inches) above the finished grade. Edges above grade shall have 12-1/2 mm (1/2 inch) chamfer. The slab shall be of adequate size to project at least 200 mm (8 inches) beyond the equipment. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 75 mm (3 inches) above slab surface. Concrete work shall be as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

E. Grounding:

1. Ground each transformer in accordance with the requirements of the NEC. Install ground rods per the requirements of Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS, to maintain a maximum resistance of 5 ohms to ground.
2. Connect the ground rod to the ground pads in the medium- and low-voltage compartments.
3. Install and connect the cable shield grounding adapter per the manufacturer's instructions. Connect the bleeder wire of the cable shield grounding adapter to the loadbreak or deadbreak elbow grounding point with minimum No. 14 AWG wire, and connect the ground braid to the grounding system with minimum No. 6 AWG bare copper wire. Use soldered or mechanical grounding connectors listed for this purpose.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer's required field tests in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests:
      a. Compare equipment nameplate data with specifications and approved shop drawings.
      b. Inspect physical and mechanical condition. Check for damaged or cracked bushings and liquid leaks.
      c. Verify that control and alarm settings on temperature indicators are as specified.
      d. Inspect all field-installed bolted electrical connections, using the calibrated torque-wrench method to verify tightness of accessible bolted electrical connections, and perform thermographic survey after energization under load.
      e. Vacuum-clean transformer interior. Clean transformer enclosure exterior.
      f. Verify correct liquid level in transformer tank.
      g. Verify correct equipment grounding per the requirements of Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
      h. Verify the presence and connection of transformer surge arresters, if provided.
      i. Verify that the tap-changer is set at rated system voltage.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall demonstrate that the transformers are in good operating condition and properly performing the intended function.

3.4 SPARE PARTS

A. Deliver the following spare parts for the project to the COR two weeks prior to final inspection:
   1. Six insulated protective caps.
   2. One spare set of medium-voltage fuses for each size and type of fuse used in the project.

3.5 INSTRUCTION

A. The Contractor shall instruct maintenance personnel, for not less than one 2-hour period, on the maintenance and operation of the equipment on the date requested by the COR.

---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 09 91 00, PAINTING: Painting of panelboards.

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 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.
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-21 ..... International Building Code

C. National Electrical Manufacturers Association (NEMA):
   PB 1-11 ..... Panelboards
   250-20 ..... Enclosures for Electrical Equipment (1,000V Maximum)

D. National Fire Protection Association (NFPA):
   70-23 ..... National Electrical Code (NEC)
   70E-21 ..... 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 will be connected.

G. Neutral bus shall be 100% rated, mounted on insulated supports.

H. Grounding bus bar shall be equipped with screws or lugs for the connection of equipment grounding conductors.

I. Bus bars shall be braced for the available short-circuit current as shown on the drawings, but not be less than 10,000 A symmetrical for 120/208 V and 120/240 V panelboards.

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.

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.

E. Circuit breaker features shall be as follows:

1. A rugged, integral housing of molded insulating material.
2. Silver alloy contacts.
3. Arc quenchers and phase barriers for each pole.
4. Quick-make, quick-break, operating mechanisms.
5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
6. Electrically and mechanically trip free.
7. An operating handle which indicates closed, tripped, and open positions.
8. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.
9. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where shown on the drawings.

2.4 SURGE PROTECTIVE DEVICES

A. Where shown on the drawings, furnish panelboards with integral surge protective devices. Refer to Section 26 43 13, SURGE PROTECTIVE DEVICES.

PART 3 - 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. 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

D. Mount panelboards such that the maximum height of the top circuit breaker above the finished floor shall not exceed 1980 mm (78 inches).

E. Provide blank cover for each unused circuit breaker mounting space.

F. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims with finishes to match surrounding surfaces after the panelboards have been installed. Do not paint nameplates.

G. Rust and scale shall be removed from the inside of existing enclosures where new interior components are to be installed. Paint inside of enclosures with rust-preventive paint before the new interior components are installed. Provide new trim. Trim shall fit tight to the enclosure.

I. 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---

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(R2020) ..... General Color Requirements for Wiring Devices
WD 6-16 ..... Wiring Devices – Dimensional Specifications

C. National Fire Protection Association (NFPA):
70-23 ..... National Electrical Code (NEC)
99-21 ..... Health Care Facilities

D. Underwriter's Laboratories, Inc. (UL):
5-16 ..... Surface Metal Raceways and Fittings
20-18 ..... 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
1449-21 ..... 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 back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.

B. Duplex Receptacles - Hospital-grade: shall be listed for hospital grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, NEMA 5-20R, with break-off feature for two-circuit operation.
1. Bodies shall be 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. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.

4. Ground Fault Current Interrupter (GFCI) Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring. GFCI receptacles shall be self-test receptacles in accordance with UL 943.
   a. Ground fault interrupter shall consist of a differential current transformer, self-test, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or – 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
   b. Self-test function shall be automatically initiated within 5 seconds after power is activated to the receptacles. Self-test function shall be periodically and automatically performed every 3 hours or less.
   c. End-of-life indicator light shall be a persistent flashing or blinking light to indicate that the GFCI receptacle is no longer in service.
5. Tamper-Resistant Duplex Receptacles:
   a. Bodies shall be gray in color.
      1) Shall permit current to flow only while a standard plug is in the proper position in the receptacle.
      2) Screws exposed while the wall plates are in place shall be the tamperproof type.

C. Duplex Receptacles – Non-hospital Grade: shall be the same as duplex receptacles – hospital grade in accordance with sections 2.1A and 2.1B of this specification, except for the hospital grade listing.
   1. Bodies shall be brown nylon.

D. Receptacles - 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.

E. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

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.

2.3 MANUAL DIMMING CONTROL

A. Electronic full-wave manual slide dimmer with on/off switch and audible frequency and EMI/RFI suppression filters.
B. Manual dimming controls shall be fully compatible with LED dimming driver and be approved by the driver manufacturer, shall operate over full specified dimming range, and shall not degrade the performance or rated life of the electronic dimming ballast and lamp.
C. Provide single-pole, three-way or four-way, as shown on the drawings.
D. Manual dimming control shall be ivory in color unless otherwise specified.

2.4 WALL PLATES

A. Wall plates for switches and receptacles shall be aged brass finish in public spaces, type 302 stainless steel in all other spaces. Oversize plates are not acceptable.
B. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
C. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.
D. Duplex Receptacles on Emergency Circuit: 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, non-Hospital grade. See paragraph 'RECEPTACLES' in this Section. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.
3. Unless otherwise shown on drawings, receptacle spacing shall be 600 mm (24 inches) on centers.
4. Conductors shall be as specified in Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE.

5. Installation fittings shall be the manufacturer's standard bends, offsets, device brackets, inside couplings, wire clips, elbows, and other components as required for a complete system.
6. Bond the assemblies to the branch circuit conduit system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC and as shown as on the drawings.
B. Install wiring devices after wall construction and painting is complete.
C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.
D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.
E. Provide barriers in multi-gang outlet boxes to comply with the NEC.
F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.
G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.
H. Install wall switches 1.2 M (48 inches) above floor, with the toggle OFF position down.
I. Install wall dimmers 1.2 M (48 inches) above floor.
J. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.
K. Install horizontally mounted receptacles with the ground pin to the right.
L. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.
M. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer's required field checks in accordance with the manufacturer's recommendations, and the latest NFPA 99. In addition, include the following:
   1. Visual Inspection and Tests:
      a. Inspect physical and electrical conditions.
      b. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.
      c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable

receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

d. Test GFCI receptacles.

2. Receptacle testing in the Patient Care Spaces, such as retention force of the grounding blade of each receptacle, shall comply with the latest NFPA 99.

---END---

SECTION 26 29 11
MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of motor controllers, including all low- and medium-voltage motor controllers and manual motor controllers, indicated as motor controllers in this section, and low-voltage variable speed motor controllers.

B. Motor controllers, whether furnished with the equipment specified in other sections or otherwise (with the exception of elevator motor controllers specified in Division 14 and fire pump controllers specified in Division 21), shall meet this specification and all related specifications.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Include electrical ratings, dimensions, weights, mounting details, materials, overcurrent protection devices, overload relays, sizes of enclosures, wiring diagrams, starting characteristics, interlocking, and accessories.
2. Manuals:
   a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
      1) Wiring diagrams shall have their terminals identified to facilitate installation, maintenance, and operation.

2) Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.
3) Elementary schematic diagrams shall be provided for clarity of operation.
4) Include the catalog numbers for the correct sizes of overload relays for the motor controllers.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the motor controllers conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the motor controllers have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. Institute of Electrical and Electronic Engineers (IEEE):
519-14 ..... Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
C37.90.1-12 ..... Standard Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus

C. International Code Council (ICC):
IBC-21 ..... International Building Code

D. National Electrical Manufacturers Association (NEMA):
ICS 1-00(R2015) ..... Industrial Control and Systems: General Requirements
ICS 1.1-84(R2020) ..... Safety Guidelines for the Application, Installation and Maintenance of Solid State Control
ICS 2-00(R2020) ..... Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 Volts
ICS 4-15 ..... Industrial Control and Systems: Terminal Blocks
ICS 6-93(R2016) ..... Industrial Control and Systems: Enclosures
ICS 7-20 ..... Industrial Control and Systems: Adjustable-Speed Drives
ICS 7.1-14 ..... Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems

E. National Fire Protection Association (NFPA):
70-23 ..... National Electrical Code (NEC)

F. Underwriters Laboratories Inc. (UL):

508A-18 ..... Industrial Control Panels

1449-14 ..... Surge Protective Devices

61800-5-1-12 ..... Adjustable Speed Electrical Power Drive Systems

PART 2 - PRODUCTS

2.1 MOTOR CONTROLLERS

A. Motor controllers shall comply with IEEE, NEMA, NFPA, UL, and as shown on the drawings.

B. Motor controllers shall be separately enclosed, unless part of another assembly. For installation in motor control centers, provide plug-in, draw-out type motor controllers up through NEMA size 4. NEMA size 5 and above require bolted connections.

C. Motor controllers shall be combination type, with magnetic controller per Paragraph 2.3 below and with fused switch disconnecting means, with external operating handle with lock-open padlocking positions and ON-OFF position indicator.

1. Fused Switches:
   a. Quick-make, quick-break type.
   b. Minimum duty rating shall be NEMA classification General Duty (GD) for 240 Volts and NEMA classification Heavy Duty (HD) for 480 Volts.
   c. Horsepower rated, and shall have the following features:
      1) Copper blades, visible in the OFF position.
      2) An arc chute for each pole.
      3) Fuse holders for the sizes and types of fuses specified or as shown on the drawings.

D. Enclosures:

1. Enclosures shall be NEMA-type rated 1, 3R, or 12 as indicated on the drawings or as required per the installed environment.
2. Enclosure doors shall be interlocked to prevent opening unless the disconnecting means is open. A "defeater" mechanism shall allow for inspection by qualified personnel with the disconnect means closed. Provide padlocking provisions.
3. All metal surfaces shall be thoroughly cleaned, phosphatized, and factory primed prior to applying light gray baked enamel finish.

E. Motor control circuits:

1. Shall operate at not more than 120 Volts.
2. Shall be grounded, except where the equipment manufacturer recommends that the control circuits be isolated.
3. For each motor operating over 120 Volts, incorporate a separate, heavy duty, control transformer within each motor controller enclosure.
4. Incorporate primary and secondary overcurrent protection for the control power transformers.

F. Overload relays:

1. Thermal type. Devices shall be NEMA type.
2. One for each pole.
3. External overload relay reset pushbutton on the door of each motor controller enclosure.
4. Overload relays shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
5. Thermal overload relays shall be tamperproof, not affected by vibration, manual reset, sensitive to single-phasing, and shall have selectable trip classes of 10, 20 and 30.

G. Hand-Off-Automatic (H-O-A) switch is required unless specifically stated on the drawings as not required for a particular controller. H-O-A switch shall be operable without opening enclosure door. H-O-A switch is not required for manual motor controllers.

H. Incorporate into each control circuit a 120 Volt, electronic time-delay relay (ON delay), minimum adjustable range from 0.3 to 10 minutes, with transient protection. Time-delay relay is not required where H-O-A switch is not required.

I. Unless noted otherwise, equip each motor controller with not less than two normally open (N.O.) and two normally closed (N.C.) auxiliary contacts.

J. Provide green (RUN) and red (STOP) pilot lights.

K. Motor controllers incorporated within equipment assemblies shall also be designed for the specific requirements of the assemblies.

L. Additional requirements for specific motor controllers, as indicated in other specification sections, shall also apply.

2.2 MANUAL MOTOR CONTROLLERS

A. Shall be in accordance with applicable requirements of 2.1 above.

B. Manual motor controllers shall have the following features:

1. Controllers shall be general-purpose Class A, manually operated type with full voltage controller for induction motors, rated in horsepower.
2. Units shall include thermal overload relays, on-off operator, red pilot light, normally open auxiliary contacts.

C. Fractional horsepower manual motor controllers shall have the following features:

1. Controllers shall be general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.
2. Units shall include thermal overload relays, red pilot light, and toggle operator.

2.3 MAGNETIC MOTOR CONTROLLERS

A. Shall be in accordance with applicable requirements of 2.1 above.

B. Controllers shall be general-purpose, Class A magnetic controllers for induction motors rated in horsepower. Minimum NEMA size 0.

C. Where combination motor controllers are used, combine controller with protective or disconnect device in a common enclosure.

D. Provide phase loss protection for each controller, with contacts to de-energize the controller upon loss of any phase.

E. Unless otherwise indicated, provide full voltage non-reversing across-the-line mechanisms for motors less than 75 HP, closed by coil action and opened by gravity. For motors 75 HP and larger, provide reduced-voltage or variable speed controllers as shown on the drawings. Equip controllers with 120 VAC coils and individual control transformer unless otherwise noted.

2.4 LOW-VOLTAGE VARIABLE SPEED MOTOR CONTROLLERS (VSMC)

A. VSMC shall be in accordance with applicable portions of 2.1 above.

B. VSMC shall be electronic, with adjustable frequency and voltage, three phase output, capable of driving standard NEMA B three-phase induction motors at full rated speed. The control technique shall be pulse width modulation (PWM), where the VSMC utilizes a full wave bridge design incorporating diode rectifier circuitry. Silicon controlled rectifiers or other control techniques are not acceptable.

C. VSMC shall be suitable for variable torque loads, and shall be capable of providing sufficient torque to allow the motor to break away from rest upon first application of power.

D. VSMC shall be capable of operating within voltage parameters of plus 10 to minus 15 percent of line voltage, and be suitably rated for the full load amps of the maximum watts (HP) within its class.

E. Minimum efficiency shall be 95 percent at 100 percent speed and 85 percent at 50 percent speed.

F. The displacement power factor of the VSMC shall not be less than 95 percent under any speed or load condition.

G. VSMC current and voltage harmonic distortion shall not exceed the values allowed by IEEE 519.

H. Operating and Design Conditions:

1. Elevation: 1000 feet Above Mean Sea Level (AMSL)
2. Temperatures: Maximum +90°F Minimum -10°F
3. Relative Humidity: 95%
4. VSMC Location: Air conditioned space

I. VSMC shall have the following features:

1. Isolated power for control circuits.
2. Manually resettable overload protection for each phase.
3. Adjustable current limiting circuitry to provide soft motor starting. Maximum starting current shall not exceed 200 percent of motor full load current.
4. Independent acceleration and deceleration time adjustment, manually adjustable from 2 to 2000 seconds. Set timers to the equipment manufacturer's recommended time in the above range.

5. Control input circuitry that will accept 4 to 20 mA current or 0-10 VDC voltage control signals from an external source.
6. Automatic frequency adjustment from 1 Hz to 300 Hz.
7. Circuitry to initiate an orderly shutdown when any of the conditions listed below occur. The VSMC shall not be damaged by any of these electrical disturbances and shall automatically restart when the conditions are corrected. The VSMC shall be able to restart into a rotating motor operating in either the forward or reverse direction and matching that frequency.
   a. Incorrect phase sequence.
   b. Single phasing.
   c. Overvoltage in excess of 10 percent.
   d. Undervoltage in excess of 15 percent.
   e. Running overcurrent above 110 percent (VSMC shall not automatically reset for this condition.)
   f. Instantaneous overcurrent above 150 percent (VSMC shall not automatically reset for this condition).
   g. Short duration power outages of 12 cycles or less (i.e., distribution line switching, generator testing, and automatic transfer switch operations.)
9. Automatic Reset/Restart: Attempt three restarts after VSMC fault or on return of power after an interruption and before shutting down for manual reset or fault correction, with adjustable delay time between restart attempts.
10. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
11. Bidirectional Autospeed Search: Capable of starting VSMC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to VSMC, motor, or load.

J. VSMC shall include an input circuit breaker which will disconnect all input power, interlocked with the door so that the door cannot be opened with the circuit breaker in the closed position.

K. VSMC shall include a 5% line reactor and a RFI/EMI filter.

L. Surge Suppression: Provide three-phase protection against damage from supply voltage surges in accordance with UL 1449.

M. VSMC shall include front-accessible operator station, with sealed keypad and digital display, which allows complete programming, operating, monitoring, and diagnostic capabilities.
   1. Typical control functions shall include but not be limited to:
      a. HAND-OFF-AUTOMATIC-RESET, with manual speed control in HAND mode.
      b. NORMAL-BYPASS.
   2. Typical monitoring functions shall include but not be limited to:

a. Output frequency (Hz).
b. Motor speed and status (run, stop, fault).
c. Output voltage and current.

3. Typical fault and alarm functions shall include but not be limited to:
   a. Loss of input signal, under- and over-voltage, inverter overcurrent, motor overload, critical frequency rejection with selectable and adjustable deadbands, instantaneous line-to-line and line-to-ground overcurrent, loss-of-phase, reverse-phase, and short circuit.
   b. System protection indicators indicating that the system has shutdown and will not automatically restart.

N. VSMC shall include two N.O. and two N.C. dry contacts rated 120 Volts, 10 amperes, 60 Hz.

O. Hardware, software, network interfaces, gateways, and programming to control and monitor the VSMC by control systems specified in other specification sections, including but not limited to Divisions 22 and 23.

P. Network communications ports: As required for connectivity to control systems specified in other specification sections, including but not limited to Divisions 22 and 23.

Q. Communications protocols: As required for communications with control systems specified in other specification sections, including but not limited to Divisions 22 and 23.

R. Bypass controller: Provide contactor-style bypass, arranged to bypass the inverter.
   1. Inverter Output Contactor and Bypass Contactor: Load-break NEMA-rated contactor.
   2. Motor overload relays.
   3. HAND-OFF-AUTOMATIC bypass control.

S. Bypass operation: Transfers motor between inverter output and bypass circuit, manually, automatically, or both. VSMC shall be capable of stable operation (starting, stopping, and running), and control by fire alarm and detection systems, with motor completely disconnected from the inverter output. Transfer between inverter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.

T. Inverter Isolating Switch: Provide non-load-break switch arranged to isolate inverter and permit safe troubleshooting and testing of the inverter, both energized and de-energized, while motor is operating in bypass mode. Include padlockable, door-mounted handle mechanism.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor controllers in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.

B. Install manual motor controllers in flush enclosures in finished areas.

C. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and electronic overload relay pickup and trip ranges.

D. Program variable speed motor controllers per the manufacturer's instructions and in coordination with other trades so that a complete and functional system is delivered.

E. Adjust trip settings of circuit breakers and motor circuit protectors with adjustable instantaneous trip elements. Initially adjust at six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficiency motors if required). Where these maximum settings do not allow starting of a motor, notify COR before increasing settings.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer's required field tests in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests:
   a. Compare equipment nameplate data with specifications and approved shop drawings.
   b. Inspect physical, electrical, and mechanical condition.
   c. Verify appropriate anchorage, required area clearances, and correct alignment.
   d. Verify that circuit breaker, motor circuit protector, and fuse sizes and types correspond to approved shop drawings.
   e. Verify overload relay ratings are correct.
   f. Vacuum-clean enclosure interior. Clean enclosure exterior.
   g. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
   h. Test all control and safety features of the motor controllers.
   i. For low-voltage variable speed motor controllers, final programming and connections shall be by a factory-trained technician. Set all programmable functions of the variable speed motor controllers to meet the requirements and conditions of use.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the motor controllers are in good operating condition and properly performing the intended functions.

3.4 SPARE PARTS

A. Two weeks prior to the final inspection, provide one complete set of spare fuses for each motor controller.

3.5 INSTRUCTION

A. Furnish the services of a factory-trained technician for two 4-hour training periods for instructing personnel in the maintenance and operation of the motor controllers, on the dates requested by the COR.

---END---

SECTION 26 29 21
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of fused and unfused disconnect switches (indicated as switches in this section), and separately-enclosed circuit breakers for use in electrical systems rated 600 V and below.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground faults.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

E. 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.
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-21 ..... International Building Code

C. National Electrical Manufacturers Association (NEMA):
FU I-12..... Low Voltage Cartridge Fuses
KS I-13..... Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum)

D. National Fire Protection Association (NFPA):
70-23 ..... National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):
98-16 ..... Enclosed and Dead-Front Switches
248 1-11 ..... Low Voltage Fuses
489-16 ..... Molded Case Circuit Breakers and Circuit Breaker Enclosures

PART 2 - PRODUCTS

2.1 FUSED SWITCHES RATED 600 AMPERES AND LESS

A. Switches shall be in accordance with NEMA, NEC, UL, as specified, and as shown on the drawings.

B. Shall be NEMA classified General Duty (GD) for 240 V switches, and NEMA classified Heavy Duty (HD) for 480 V switches.

C. Shall be horsepower (HP) rated.

D. Shall have the following features:
   1. Switch mechanism shall be the quick-make, quick-break type.
   2. Copper blades, visible in the open position.
   3. An arc chute for each pole.

4. External operating handle shall indicate open and closed positions, and have lock-open padlocking provisions.
5. Mechanical interlock shall permit opening of the door only when the switch is in the open position, defeatable to permit inspection.
6. Fuse holders for the sizes and types of fuses specified.
7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
8. Ground lugs for each ground conductor.
9. Enclosures:
   a. Shall be the NEMA types shown on the drawings.
   b. Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions.
   c. Shall be finished with manufacturer's standard gray baked enamel paint over pretreated steel.

2.2 UNFUSED SWITCHES RATED 600 AMPERES AND LESS

A. Shall be the same as fused switches, but without provisions for fuses.

2.3 FUSED SWITCHES RATED OVER 600 AMPERES TO 1200 AMPERES

A. Shall be the same as fused switches, and shall be NEMA classified Heavy Duty (HD).

2.4 MOTOR RATED TOGGLE SWITCHES

A. Type 1, general purpose for single-phase motors rated up to 1 horsepower.
B. Quick-make, quick-break toggle switch with external reset button and thermal overload protection matched to nameplate full-load current of actual protected motor.

2.5 CARTRIDGE FUSES

A. Shall be in accordance with NEMA FU 1.
C. Feeders: Class RK1, time delay.
D. Motor Branch Circuits: Class RK1, time delay.
E. Other Branch Circuits: Class RK1, time delay.
F. Control Circuits: Class CC, 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. Fused switches shall be furnished complete with fuses. Arrange fuses such that rating information is readable without removing the fuses.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests:
   a. Compare equipment nameplate data with specifications and approved shop drawings.
   b. Inspect physical, electrical, and mechanical condition.
   c. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method.
   d. Vacuum-clean enclosure interior. Clean enclosure exterior.

3.3 SPARE PARTS

A. Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fused disconnect switch installed on the project. Deliver the spare fuses to the COR.

---END---

SECTION 26 41 00
FACILITY LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing and installation of a complete UL master labeled lightning protection system.

1.2 RELATED WORK

A. Section 07 60 00, FLASHING AND SHEET METAL: Penetrations through the roof.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground faults.

D. Section 26 43 13, SURGE PROTECTIVE DEVICES: Surge protective device installed at the electrical service entrance.

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. Show locations of air terminals, connections to required metal surfaces, down conductors, and grounding means.
   c. Show the mounting hardware and materials used to attach air terminals and conductors to the structure.
2. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the lightning protection system conforms to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the lightning protection system has been properly installed and inspected.
   c. Certification that the lightning protection system has been inspected by a UL representative and has been approved by UL without variation.

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. National Fire Protection Association (NFPA):

70-23 ..... National Electrical Code (NEC)

780-23 ..... Standard for the Installation of Lightning Protection Systems

C. Underwriters Laboratories, Inc. (UL):

96-16 ..... Lightning Protection Components

96A-16..... Installation Requirements for Lightning Protection Systems

467-22 ..... Standard for Grounding and Bonding Equipment

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Lightning protection components shall conform to NFPA 780 and UL 96, for use on Class I structures. Copper materials are required.

1. Class I conductors: Copper.
2. Class I air terminals: Solid copper, 460 mm (18 inches) long, not less than 9.5 mm (3/8 inch) diameter, with blunt bare copper points.
3. Ground rods: Copper-clad steel, 0.75 in (19 mm) diameter by 3 m (10 feet) long.
4. Ground plates: Solid copper, not less than 20 gauge.
5. Bonding plates: Bronze, 50 square cm (8 square inches).
6. Through roof connectors: Solid copper riser bar, length and type as required to accommodate roof structure and flashing requirements.
7. Down conductor guards: Stiff copper or brass.
8. Anchors and fasteners: Bronze bolt and clamp type shall be used for all applications except for membrane roof. Adhesive type are allowed only for attachment to membrane roof materials, using adhesive that is compatible with the membrane material.
9. Connectors: Bronze clamp-type connectors shall be used for roof conductor splices, and the connection of the roof conductor to air terminals and bonding plates. Crimp-type connectors are not allowed.
10. Exothermic welds: Exothermic welds shall be used for splicing the roof conductor to the down conductors, splices of the down conductors, and for connection of the down conductors to ground rods, ground plates, and the ground ring.

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. Coordinate installation with the roofing manufacturer and roofing installer.

C. Install the conductors as inconspicuously as practical.

D. Install the down conductors within the concealed cavity of exterior walls where practical. Run the down conductors to the exterior at elevations below the finished grade.

E. Where down conductors are subject to damage or are accessible near grade, protect with down conductor guards to 2.4 m (8 feet) above grade. Bond down conductors guards to down conductor at both ends.

F. Make connections of dissimilar metal with bimetallic type fittings to prevent electrolytic action.

G. Install ground rods and ground plates not less than 600 mm (2 feet) deep and a distance not less than 900 mm (3 feet) nor more than 2.5 m (8 feet) from the nearest point of the structure. Exothermically weld the down conductors to ground rods and ground plates in the presence of the COR.

H. Bond down conductors to metal main water piping where applicable.

I. Bond down conductors to building structural steel.

J. Connect roof conductors to all metallic projections and equipment above the roof as indicated on the drawings.

K. Connect exterior metal surfaces, located within 900 mm (3 feet) of the conductors, to the conductors to prevent flashovers.

L. Maintain horizontal or downward coursing of main conductor and insure that all bends have at least an 200 mm (8 inches) radius and do not exceed 90 degrees.

M. Conductors shall be rigidly fastened every 900 mm (3 feet) along the roof and down to the building to ground.

N. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure.

O. Install air terminal bases, cable holders and other roof-system supporting means without piercing membrane or metal roofs.

P. Use through-roof connectors for penetration of the roof system. Flashing shall be provided by roofing contractor in accordance with Section 07 60 00, FLASHING AND SHEET METAL.

Q. Down conductors coursed on or in reinforced concrete columns or on structural steel columns shall be connected to the reinforcing steel or the structural steel member at its upper and lower

extremities. In the case of long vertical members an additional connection shall be made at intervals not exceeding 30 M (100 feet).

R. A counterpoise or ground ring, where shown, shall be of No. 1/0 copper cable having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 600 mm (2 feet) deep at a distance not less than 900 mm (3 feet) nor more than 2.5 M (8 feet) from the nearest point of the structure.

S. On construction utilizing post tensioning systems to secure precast concrete sections, the post tension rods shall not be used as a path for lightning to ground.

T. Where shown, use the structural steel framework or reinforcing steel as the down conductor.
   1. Weld or bond the non-electrically-continuous sections together and make them electrically continuous.
   2. Verify the electrical continuity by measuring the ground resistances to earth at the ground level, at the top of the building or stack, and at intermediate points with a sensitive ohmmeter. Compare the resistance readings.
   3. Connect the air terminals together with an exterior conductor connected to the structural steel framework at not more than 18 M (60 feet) intervals.
   4. Install ground connections to earth at not more than 18 M (60 feet) intervals around the perimeter of the building.
   5. Weld or braze bonding plates to cleaned sections of the steel and connect the conductors to the plates.
   6. Do not pierce the structural steel in any manner. Connections to the structural steel shall conform to UL 96A.

U. Where the drawings show the new lightning protection system connected to an existing lightning protection system with or without a UL master label, the new portion of the lightning protection system requires UL inspection and a Letter of Findings.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Test the ground resistance to earth by standard methods, and conform to the ground resistance requirements specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

B. A UL representative shall inspect the lightning protection system. Obtain and install a UL numbered master label for each of the lightning protection systems at the location directed by the UL representative and 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 SWITCHGEAR/SWITCHBOARD SPD

A. General Requirements:

1. Comply with IEEE and UL.
2. Modular design with field-replaceable modules, or non-modular design.
3. Fuses, rated at 200 kA interrupting capacity.
4. Bolted compression lugs for internal wiring.
5. Integral disconnect switch.
6. Redundant suppression circuits.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
10. Four-digit transient-event counter.

B. Surge Current per Phase: Minimum 240kA per phase.

2.2 PANELBOARD SPD

A. General Requirements:

1. Comply with UL 1449 and IEEE C62.41.2.
2. Modular design with field-replaceable modules, or non-modular design.
3. Fuses, rated at 200 kA interrupting capacity.
4. Bolted compression lugs for internal wiring.
5. Integral disconnect switch.
6. Redundant suppression circuits.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.

9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
10. Four-digit transient-event counter.

B. Surge Current per Phase: Minimum 120kA per phase.

2.3 ENCLOSURES

A. Enclosures: NEMA 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.

B. Factory-installed SPD: Switchgear, switchboard, or panelboard manufacturer shall install SPD at the factory.

C. Field-installed SPD: Contractor shall install SPD with conductors or buses between SPD and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide a circuit breaker as a dedicated disconnecting means for TVSS as shown on drawings.

D. Do not perform insulation resistance tests on switchgear, switchboards, panelboards, or feeders with the SPD connected. Disconnect SPD before conducting insulation resistance tests, and reconnect SPD immediately after insulation resistance tests are complete.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests:
   a. Compare equipment nameplate data with specifications and approved shop drawings.
   b. Inspect physical, electrical, and mechanical condition.
   c. Verify that disconnecting means and feeder size and maximum length to SPD corresponds to approved shop drawings.
   d. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.
   e. Vacuum-clean enclosure interior. Clean enclosure exterior.
   f. Verify the correct operation of all sensing devices, alarms, and indicating devices.

3.3 FOLLOW-UP VERIFICATION

A. After completion of acceptance checks and tests, the Contractor shall show by demonstration in service that SPD are in good operating condition and properly performing the intended function.

3.4 INSTRUCTION

A. Provide the services of a factory-trained technician for one 2-hour training period for instructing personnel in the maintenance and operation of the SPD, on the date requested by the COR.

`---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 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

D. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

F. 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-22..... Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

C. Environmental Protection Agency (EPA):
   40 CFR 261-21 ..... 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-79-19 ..... Electrical and Photometric Measurements of Solid-State Lighting Products
   LM-80-21 ..... Measuring Lumen Maintenance of LED Light Sources
   LM-82-19 ..... 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-21 ..... International Building Code

H. National Electrical Manufacturer's Association (NEMA):
   C78.376-14 (R2021) ..... Chromaticity of Fluorescent Lamps

C82.1-04(S2021) ..... Lamp Ballasts – Line Frequency Fluorescent Lamp Ballasts

C82.2-02(S2021) ..... Method of Measurement of Fluorescent Lamp Ballasts

C82.4-17..... Lamp Ballasts - Ballasts for High-Intensity Discharge and Low-Pressure Sodium (LPS) Lamps (Multiple-Supply Type)

C82.11-17..... Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts

LL 9-11 ..... Dimming of T8 Fluorescent Lighting Systems

SSL 1-16..... Electronic Drivers for LED Devices, Arrays, or Systems

I. National Fire Protection Association (NFPA):

70-23 ..... National Electrical Code (NEC)

101-21 ..... Life Safety Code

J. Underwriters Laboratories, Inc. (UL):

496-17 ..... Lampholders

542-05 ..... Fluorescent Lamp Starters

844-12 ..... Luminaires for Use in Hazardous (Classified) Locations

924-16 ..... Emergency Lighting and Power Equipment

935-01 ..... Fluorescent-Lamp Ballasts

1029-94 ..... High-Intensity-Discharge Lamp Ballasts

1029A-06.....Outline of Investigation for Ignitors and Related Auxiliaries for HID Lamp Ballasts

1574-04.....Standard for Safety Track Lighting Systems

1598-21 ..... Standard for Safety Luminaires

2108-15.....Standard for Safety Low-Voltage Lighting Systems

8750-15.....Standard for Safety Light Emitting Diode (LED) Light Sources for Use in Lighting Products

PART 2 - PRODUCTS

2.1 LED EXIT LIGHT FIXTURES

A. Exit light fixtures shall meet applicable requirements of NFPA and UL.

B. Housing and door shall be die-cast aluminum.

C. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.

D. Finish shall be satin or fine-grain brushed aluminum.

E. There shall be no radioactive material used in the fixtures.

F. Fixtures:

1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or

fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.

2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

G. Voltage: Multi-voltage (120 – 277V).

2.2 LED LIGHT FIXTURES

A. General:
1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
3. LED drivers shall include the following features unless otherwise indicated:
   a. Minimum efficiency: 85% at full load.
   b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)
   c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
   d. Integral short circuit, open circuit, and overload protection.
   e. Power Factor: ≥ 0.95.
   f. Total Harmonic Distortion: ≤ 20%.
   g. Comply with FCC 47 CFR Part 15.
4. LED modules shall include the following features unless otherwise indicated:
   a. Comply with IES LM-79 and LM-80 requirements.
   b. Minimum CRI: 80 or higher. Minimum Color Fidelity Index (IES Rf): 80 or higher.
   c. Color temperature between 3500° - 5000°K and as specified in the drawings' LIGHTING FIXTURE SCHEDULE.
   d. Minimum Rated Life: 50,000 hours per IES L70.
   e. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

B. LED Downlights:
1. Housing, LED driver, and LED module shall be products of the same manufacturer.

C. LED Troffers:
1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
2. Housing, LED driver, and LED module shall be products of the same manufacturer.

D. LED Emergency Battery Driver:
1. Input voltage: 120-277 Volt at 60Hz.
2. Illumination time: 90 minutes.

3. Operating temperature: 0˚C to 55˚C (32˚F to 131˚F).
4. Battery: Lithium Ferro Phosphate (LIF)technology, maintenance-free, and high-temperature. Battery shall be integral with the LED Emergency Battery Driver unit.
5. Test switch: IP65 rated to protect against dust and water.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, manufacturer's instructions, and as shown on the drawings or specified.

B. Align, mount, and level the lighting fixtures uniformly.

C. Wall-mounted fixtures shall be attached to the studs in the walls, or to a 20 gauge metal backing plate that is attached to the studs in the walls. Lighting fixtures shall not be attached directly to gypsum board.

D. Lighting Fixture Supports:

1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
4. Hardware for recessed fluorescent fixtures:
   a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.
   b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.
5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:
   a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 6 mm (1/4 inch) secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
   b. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 6 mm (1/4 inch) studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 6 mm (1/4 inch) toggle

bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

c. In addition to the above, the following is required for fixtures exceeding 9 kg (20 pounds) in weight.
   1) Where fixtures mounted in ASTM Standard C635 "Intermediate Duty" and "Heavy Duty" ceilings and weigh between 9 kg and 25 kg (20 pounds and 56 pounds), provide two 12 gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
   2) Where fixtures weigh over 25 kg (56 pounds), they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.

d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

6. Surface mounted lighting fixtures:
   a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6 mm (1/4 inch) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25 kg (56 pounds) shall be supported directly from the building structure.
   b. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
   c. Fixtures less than 6.8 kg (15 pounds) in weight and occupying less than 3715 sq cm (two square feet) of ceiling area may, when designed for the purpose, be supported directly from the outlet box when all the following conditions are met.
      1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.
      2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
      3) The outlet box is supported vertically from the building structure.
   d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.

7. Single or double pendant-mounted lighting fixtures:
   a. Each stem shall be supported by an approved outlet box mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.
8. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.

E. Furnish and install the new lamps as specified for all lighting fixtures installed under this project, and for all existing lighting fixtures reused under this project.

F. The electrical and ceiling trades shall coordinate to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges, etc.), to match the ceiling system being installed.

G. Bond lighting fixtures to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

H. At completion of project, replace all defective components of the lighting fixtures at no cost to the Government.

I. Dispose of lamps per requirements of Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT, and Section 02 41 00, DEMOLITION.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform the following:
   1. Visual Inspection:
      a. Verify proper operation by operating the lighting controls.
      b. Visually inspect for damage to fixtures, lenses, reflectors, diffusers, and louvers. Clean fixtures, lenses, reflectors, diffusers, and louvers that have accumulated dust, dirt, or fingerprints during construction.
   2. Electrical tests:
      a. Exercise dimming components of the lighting fixtures over full range of dimming capability by operating the control devices(s) in the presence of the COR. Observe for visually detectable flicker over full dimming range, and replace defective components at no cost to the Government.
      b. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless specifically recommended otherwise by the lamp manufacturer. Burn-in dimmed fluorescent and compact fluorescent lamps for at least 100 hours at full voltage, unless specifically

recommended otherwise by the lamp manufacturer. Replace any lamps and ballasts which fail during burn-in.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting systems are in good operating condition and properly performing the intended function.

---END---

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of exterior fixtures, poles, and supports. The terms “lighting fixtures”, “fixture” and “luminaire” are used interchangeably.

1.2 RELATED WORK

A. Section 03 30 00, CAST-IN-PLACE CONCRETE.

B. Section 09 06 00, SCHEDULE FOR FINISHES: Finishes for exterior light poles and luminaires.

C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

D. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.

E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

F. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.

G. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground handholes and conduits.

H. Section 26 09 23, LIGHTING CONTROLS: Controls for exterior lighting.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:

   a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.

   b. Material and construction details, include information on housing and optics system.

   c. Physical dimensions and description.

   d. Wiring schematic and connection diagram.

   e. Installation details.

   f. Energy efficiency data.

   g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.

h. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours), and color temperature (degrees Kelvin).

i. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts, and total harmonic distortion (THD).

j. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.

k. Submit site plan showing all exterior lighting fixtures with fixture tags consistent with Lighting Fixture Schedule as shown on drawings. Site plan shall show computer generated point–by-point illumination calculations. Include lamp lumen and light loss factors used in calculations.

2. Manuals:

a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.

a. Certification by the Contractor that the exterior lighting systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Association of State Highway and Transportation Officials (AASHTO):

LRFDLTS-17..... Structural Supports for Highway Signs, Luminaires and Traffic Signals

C. American Concrete Institute (ACI):

318-19 ..... Building Code Requirements for Structural Concrete

D. American National Standards Institute (ANSI):

H35.1/H35 1M-17..... American National Standard Alloy and Temper Designation Systems for Aluminum

E. American Society for Testing and Materials (ASTM):

A123/A123M-17 ..... Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M-16..... Zinc Coating (Hot-Dip) on Iron and Steel Hardware

B108/B108M-19 ..... Aluminum-Alloy Permanent Mold Castings

C1089-19 ..... Spun Cast Prestressed Concrete Poles

F. Federal Aviation Administration (FAA):

AC 70/7460-IL-20..... Obstruction Marking and Lighting

AC 150/5345-43J-19..... Specification for Obstruction Lighting Equipment

G. Illuminating Engineering Society of North America (IESNA):

RP-8-21 ..... Roadway Lighting

LM-72-20 ..... Directional Positioning of Photometric Data

LM-79-19 ..... Approved Method for the Electrical and Photometric Measurements of Solid-Sate Lighting Products

LM-80-21 ..... Approved Method for Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules

TM-15-20..... Luminaire Classification System for Outdoor Luminaires

H. National Electrical Manufacturers Association (NEMA):

C78.41-16..... Electric Lamps – Guidelines for Low-Pressure Sodium Lamps

C78.42-09(R2016) ..... Electric Lamps – Guidelines for High-Pressure Sodium Lamps

C78.43-17 ..... Electric Lamps – Single-Ended Metal-Halide Lamps

C78.1381-98..... Electric Lamps – 70-Watt M85 Double-Ended Metal-Halide Lamps

C81.61-19 ..... Electrical Lamp Bases – Specifications for Bases (Caps) for Electric Lamps

C82.4-17 ..... Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

C136.3-20 ..... For Roadway and Area Lighting Equipment – Luminaire Attachments

C136.17-05(S2017) ..... Roadway and Area Lighting Equipment – Enclosed Side-Mounted Luminaires for Horizontal-Burning High-Intensity-Discharge Lamps – Mechanical Interchangeability of Refractors

ICS 2-00(R2020) ..... Controllers, Contactors and Overload Relays Rated 600 Volts

ICS 6-93(R2016) ..... Enclosures

I. National Fire Protection Association (NFPA):

70-23 ..... National Electrical Code (NEC)

101-21 ..... Life Safety Code

J. Underwriters Laboratories, Inc. (UL):

496-17 ..... Lampholders

773-16 ..... Plug-In, Locking Type Photocontrols for Use with Area Lighting

773A-16 ..... Nonindustrial Photoelectric Switches for Lighting Control

1029-94 ..... High-Intensity-Discharge Lamp Ballasts

1598-21 ..... Luminaires

8750-15.....Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.6 DELIVERY, STORAGE, AND HANDLING

Provide manufacturer's standard provisions for protecting pole finishes during transport, storage, and installation. Do not store poles on ground. Store poles so they are at least 305 mm (12 inches) above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

Luminaires, materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

2.2 LUMINAIRES

A. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat, and safe cleaning and relamping.

B. Illumination distribution patterns, BUG ratings and cutoff types as defined by the IESNA shall be as shown on the drawings.

C. Incorporate ballasts in the luminaire housing, except where otherwise shown on the drawings.

D. Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

E. Lamp sockets for high intensity discharge (H.I.D) fixture shall have locking-type porcelain enclosures in conformance to the applicable requirements of ANSI C81.61-09 and UL 496-08.

F. Pre-wire internal components to terminal strips at the factory.

G. Bracket-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.

H. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.

I. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of pole or support materials. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.

J. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

2.3 LAMPS

A. LED sources shall meet the following requirements:

1. Operating temperature rating shall be between -40 degrees C (-40 degrees F) and 50 degrees C (120 degrees F).

2. Correlated Color Temperature (CCT): 4000K.
3. Color Rendering Index (CRI): ≥ 80.
4. The manufacturer shall have performed reliability tests on the LEDs luminaires complying with Illuminating Engineering Society (IES) LM79 for photometric performance and LM80 for lumen maintenance and L70 life.

2.4 LED DRIVERS

A. LED drivers shall meet the following requirements:
   1. Drivers shall have a minimum efficiency of 85%.
   2. Starting Temperature: -40 degrees C (-40 degrees F).
   3. Input Voltage: 120 to 480 (±10%) volt.
   4. Power Supplies: Class I or II output.
   5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
   6. Power Factor (PF): ≥ 0.90.
   7. Total Harmonic Distortion (THD): ≤ 20%.
   8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
   9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

2.5 EXISTING LIGHTING SYSTEMS

A. For modifications or additions to existing lighting systems, the new components shall be compatible with the existing systems.
B. New luminaires shall have approximately the same configurations, dimensions, lamping and reflector type as the existing poles and luminaires, except where otherwise shown on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer’s recommendations.
B. Install lamps in each luminaire.
C. Adjust luminaires that require field adjustment or aiming.

3.2 GROUNDING

Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a

metal other than copper, provide specially-treated or lined connectors suitable and listed for this purpose.

3.3 ACCEPTANCE CHECKS AND TESTS

Verify operation after installing luminaires and energizing circuits.

- - - E N D - - -

SECTION 27 05 11
REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes common requirements to communications installations and applies to all sections of Division 27 and Division 28.

B. Provide completely functioning communications systems.

C. Comply with VAAR 852.236.91 and FAR clause 52.236-21 in circumstance of a need for additional detail or conflict between drawings, specifications, reference standards or code.

1.2 REFERENCES

A. Abbreviations and Acronyms

1. Refer to http://www.cfm.va.gov/til/sdetail.asp for Division 00, ARCHITECTURAL ABBREVIATIONS.

2. Additional Abbreviations and Acronyms:

A	Ampere
AC	Alternating Current
AE	Architect and Engineer
AFF	Above Finished Floor
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
AWG	American Wire Gauge (refer to STP and UTP)
AWS	Advanced Wireless Services
BCT	Bonding Conductor for Telecommunications (also Telecommunications Bonding Conductor (TBC))
BDA	Bi-Directional Amplifier
BICSI	Building Industry Consulting Service International
BIM	Building Information Modeling
BOM	Bill of Materials
BTU	British Thermal Units
BUCR	Back-up Computer Room
BTS	Base Transceiver Station
CAD	AutoCAD
CBOPC	Community Based Out Patient Clinic
CBC	Coupled Bonding Conductor

CBOC	Community Based Out Patient Clinic (refer to CBOPC, OPC, VAMC)
CCS	TIP's Cross Connection System (refer to VCCS and HCCS)
CFE	Contractor Furnished Equipment
CFM	US Department of Veterans Affairs Office of Construction and Facilities Management
CFR	Consolidated Federal Regulations
CIO	Communication Information Officer (Facility, VISN or Region)
cm	Centimeters
CO	Central Office
COR	Contracting Officer Representative
CPU	Central Processing Unit
CSU	Customer Service Unit
CUP	Conditional Use Permit(s) – Federal/GSA for VA
dB	Decibel
dBm	Decibel Measured
dBmV	Decibel per milli-Volt
DC	Direct Current
DEA	United States Drug Enforcement Administration
DSU	Data Service Unit
EBC	Equipment Bonding Conductor
ECC	Engineering Control Center (refer to DCR, EMCR)
EDGE	Enhanced Data (Rates) for GSM Evolution
EDM	Electrical Design Manual
EMCR	Emergency Management Control Room (refer to DCR, ECC)
EMI	Electromagnetic Interference (refer to RFI)
EMS	Emergency Medical Service
EMT	Electrical Metallic Tubing or thin wall conduit
ENTR	Utilities Entrance Location (refer to DEMARC, POTS, LEC)
EPBX	Electronic Digital Private Branch Exchange
ESR	Vendor’s Engineering Service Report
FA	Fire Alarm
FAR	Federal Acquisition Regulations in Chapter 1 of Title 48 of Code of Federal Regulations

FMS	VA's Headquarters or Medical Center Facility's Management Service
FR	Frequency (refer to RF)
FTS	Federal Telephone Service
GFE	Government Furnished Equipment
GPS	Global Positioning System
GRC	Galvanized Rigid Metal Conduit
GSM	Global System (Station) for Mobile
HCCS	TIP's Horizontal Cross Connection System (refer to CCS & VCCS)
HDPE	High Density Polyethylene Conduit
HDTV	Advanced Television Standards Committee High-Definition Digital Television
HEC	Head End Cabinets(refer to HEIC, PA)
HEIC	Head End Interface Cabinets(refer to HEC, PA)
HF	High Frequency (Radio Band; Re FR, RF, VHF & UHF)
HSPA	High Speed Packet Access
HZ	Hertz
IBT	Intersystem Bonding Termination (NEC 250.94)
IC	Intercom
ICRA	Infectious Control Risk Assessment
IDEN	Integrated Digital Enhanced Network
IDC	Insulation Displacement Contact
IDF	Intermediate Distribution Frame
ILSM	Interim Life Safety Measures
IMC	Rigid Intermediate Steel Conduit
IRM	Department of Veterans Affairs Office of Information Resources Management
ISDN	Integrated Services Digital Network
ISM	Industrial, Scientific, Medical
IWS	Intra-Building Wireless System
LAN	Local Area Network
LBS	Location Based Services, Leased Based Systems
LEC	Local Exchange Carrier (refer to DEMARC, PBX & POTS)
LED	Light Emitting Diode

LMR	Land Mobile Radio
LTE	Long Term Evolution, or 4G Standard for Wireless Data Communications Technology
M	Meter
MAS	Medical Administration Service
MATV	Master Antenna Television
MCR	Main Computer Room
MCOR	Main Computer Operators Room
MDF	Main Distribution Frame
MH	Manholes or Maintenance Holes
MHz	Megaherts (10^6 Hz)
mm	Millimeter
MOU	Memorandum of Understanding
MW	Microwave (RF Band, Equipment or Services)
NID	Network Interface Device (refer to DEMARC)
NEC	National Electric Code
NOR	Network Operations Room
NRTL	OSHA Nationally Recognized Testing Laboratory
NS	Nurse Stations
NTIA	U.S. Department of Commerce National Telecommunications and Information Administration
OEM	Original Equipment Manufacturer
OI&T	Office of Information and Technology
OPC	VA's Outpatient Clinic (refer to CBOC, VAMC)
OSH	Department of Veterans Affairs Office of Occupational Safety and Health
OSHA	United States Department of Labor Occupational Safety and Health Administration
OTDR	Optical Time-Domain Reflectometer
PA	Public Address System (refer to HE, HEIC, RPEC)
PBX	Private Branch Exchange (refer to DEMARC, LEC, POTS)
PCR	Police Control Room (refer to SPCC, could be designated SCC)
PCS	Personal Communications Service (refer to UPCS)
PE	Professional Engineer

PM	Project Manager
PoE	Power over Ethernet
POTS	Plain Old Telephone Service (refer to DEMARC, LEC, PBX)
PSTN	Public Switched Telephone Network
PSRAS	Public Safety Radio Amplification Systems
PTS	Pay Telephone Station
PVC	Poly-Vinyl Chloride
PWR	Power (in Watts)
RAN	Radio Access Network
RBB	Rack Bonding Busbar
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 http://www.cfm.va.gov/TIL/cPro.asp:

1. Federal Communications Commission, (FCC) CFR, Title 47:

Part 15	Restrictions of use for Part 15 listed RF Equipment in Safety of Life Emergency Functions and Equipment Locations
Part 47	Chapter A, Paragraphs 6.1-6.23, Access to Telecommunications Service, Telecommunications Equipment and Customer Premises Equipment
Part 58	Television Broadcast Service
Part 73	Radio and Television Broadcast Rules
Part 90	Rules and Regulations, Appendix C
Form 854	Antenna Structure Registration
Chapter XXIII	National Telecommunications and Information Administration (NTIA, P/O Commerce, Chapter XXIII) the 'Red Book'– Chapters 7, 8 & 9 compliments CFR, Title 47, FCC Part 15, RF Restriction of Use and Compliance in "Safety of Life" Functions & Locations

2. US Department of Agriculture, (Title 7, USC, Chapter 55, Sections 2201, 2202 & 2203:RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction:

RUS Bull 1751F-630	Design of Aerial Cable Plants
RUS Bull 1751F-640	Design of Buried Cable Plant, Physical Considerations
RUS Bull 1751F-643	Underground Plant Design
RUS Bull 1751F-815	Electrical Protection of Outside Plants,
RUS Bull 1753F-201	Acceptance Tests of Telecommunications Plants (PC-4)
RUS Bull 1753F-401	Splicing Copper and Fiber Optic Cables (PC-2)
RUS Bull 345-50	Trunk Carrier Systems (PE-60)
RUS Bull 345-65	Shield Bonding Connectors (PE-65)
RUS Bull 345-72	Filled Splice Closures (PE-74)
RUS Bull 345-83	Gas Tube Surge Arrestors (PE-80)

3. US Department of Commerce/National Institute of Standards Technology,(NIST):

FIPS PUB 1-1	Telecommunications Information Exchange
FIPS PUB 100/1	Interface between Data Terminal Equipment (DTE) Circuit Terminating Equipment for operation with Packet Switched Networks, or Between Two DTEs, by Dedicated Circuit
FIPS PUB 140/2	Telecommunications Information Security Algorithms

FIPS PUB 143	General Purpose 37 Position Interface between DTE and Data Circuit Terminating Equipment
FIPS 160/2	Electronic Data Interchange (EDI),
FIPS 175	Federal Building Standard for Telecommunications Pathway and Spaces
FIPS 191	Guideline for the Analysis of Local Area Network Security
FIPS 197	Advanced Encryption Standard (AES)
FIPS 199	Standards for Security Categorization of Federal Information and Information Systems

4. US Department of Defense, (DoD):

MIL-STD-188-110	Interoperability and Performance Standards for Data Modems
MIL-STD-188-114	Electrical Characteristics of Digital Interface Circuits
MIL-STD-188-115	Communications Timing and Synchronizations Subsystems
MIL-C-28883	Advanced Narrowband Digital Voice Terminals
MIL-C-39012/21	Connectors, Receptacle, Electrical, Coaxial, Radio Frequency, (Series BNC (Uncabled), Socket Contact, Jam Nut Mounted, Class 2)

5. US Department of Health and Human Services:
   The Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy, Security and Breach Notification Rules
6. US Department of Justice:
   2010 Americans with Disabilities Act Standards for Accessible Design (ADAAD).
7. US Department of Labor, (DoL) - Public Law 426-62 – CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standards):

Subpart 7	Approved NRTLs; obtain a copy at https://www.osha.gov/dts/otpca/nrtl/nrtllist.html
Subpart 35	Compliance with NFPA 101, Life Safety Code
Subpart 36	Design and Construction Requirements for Exit Routes
Subpart 268	Telecommunications
Subpart 305	Wiring Methods, Components, and Equipment for General Use
Subpart 508	Americans with Disabilities Act Accessibility Guidelines; technical requirement for accessibility to buildings and facilities by individuals with disabilities

8. US Department of Transportation, (DoT):

a. Public Law 85-625, CFR, Title 49, Part 1, Subpart C – Federal Aviation Administration (FAA):AC 110/460-ID & AC 707 / 460-2E – Advisory Circulars Standards for Construction of Antenna Towers, and 7450 and 7460-2 – Antenna Construction Registration Forms.

9. US Department of Veterans Affairs (VA): Office of Telecommunications (OI&T), MP-6, PART VIII, TELECOMMUNICATIONS, CHAPTER 5, AUDIO, RADIO AND TELEVISION (and COMSEC) COMMUNICATIONS SYSTEMS: Spectrum Management and COMSEC Service (SMCS), AHJ for:

a. CoG, “Continuance of Government” communications guidelines and compliance.

b. COMSEC,“VA wide coordination and control of security classified communication assets.”

c. COOP, “Continuance of Operations” emergency communications guidelines and compliance.

d. FAA, FCC, and US Department of Commerce National Telecommunications and Information Administration, “VA wide RF Co-ordination, Compliance and Licensing.”

e. Handbook 6100 – Telecommunications: Cyber and Information Security Office of Cyber and Information Security, and Handbook 6500 – Information Security Program.

f. Low Voltage Special Communications Systems “Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance and Life Safety Certifications for CFM and VA Facility Low Voltage Special Communications Projects (except Fire Alarm, Telephone and Data Systems).”

g. SATCOM, “Satellite Communications” guidelines and compliance, and Security and Law Enforcement Systems – “Coordinates the Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance, DEA and Public Safety Certification(s) for CFM and VA Facility Security Low Voltage Special Communications and Physical Security Projects.

h. VHA’s National Center for Patient Safety – Veterans Health Administration (VHA) Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.

i. VA’s CEOSH, concurrence with warning identified in VA Directive 7700.

j. Wireless and Handheld Devices, “Guidelines and Compliance,”

k. Office of Security and Law Enforcement: VA Directive 0730 and Health Special Presidential Directive (HSPD)-12.

C. NRTL Standards: Refer to https://www.osha.gov/laws-regs/regulations/standardnumber/1926

1. Canadian Standards Association (CSA); same tests as presented by UL

2. Communications Certifications Laboratory (CEL); same tests as presented by UL.

3. Intertek Testing Services NA, Inc., (ITSNA), formerly Edison Testing Laboratory (ETL) same tests as presented by UL).

4. Underwriters Laboratory (UL):

1-2005	Flexible Metal Conduit
5-2011	Surface Metal Raceway and Fittings
6-2007	Rigid Metal Conduit
44-010	Thermoset-Insulated Wires and Cables
50-1995	Enclosures for Electrical Equipment
65-2010	Wired Cabinets
83-2008	Thermoplastic-Insulated Wires and Cables
96-2005	Lightning Protection Components
96A-2007	Installation Requirements for Lightning Protection Systems
360-2013	Liquid-Tight Flexible Steel Conduit
444-2008	Communications Cables
467-2013	Grounding and Bonding Equipment
486A-486B-2013	Wire Connectors
486C-2013	Splicing Wire Connectors
486D-2005	Sealed Wire Connector Systems
486E-2009	Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
493-2007	Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
497/497A/497B/497C	
497D/497E	Protectors for Paired Conductors/Communications Circuits/Data Communications and Fire Alarm Circuits/coaxial circuits/voltage protections/Antenna Lead In
510-2005	Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
514A-2013	Metallic Outlet Boxes
514B-2012	Fittings for Cable and Conduit
514C-1996	Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-2011	Schedule 40 and 80 Rigid PVC Conduit
651A-2011	Type EB and A Rigid PVC Conduit and HDPE Conduit
797-2007	Electrical Metallic Tubing
884-2011	Underfloor Raceways and Fittings
1069-2007	Hospital Signaling and Nurse Call Equipment
1242-2006	Intermediate Metal Conduit
1449-2006	Standard for Transient Voltage Surge Suppressors
1479-2003	Fire Tests of Through-Penetration Fire Stops

1480-2003	Speaker Standards for Fire Alarm, Emergency, Commercial and Professional use
1666-2007	Standard for Wire/Cable Vertical (Riser) Tray Flame Tests
1685-2007	Vertical Tray Fire Protection and Smoke Release Test for Electrical and Fiber Optic Cables
1861-2012	Communication Circuit Accessories
1863-2013	Standard for Safety, communications Circuits Accessories
1865-2007	Standard for Safety for Vertical-Tray Fire Protection and Smoke-Release Test for Electrical and Optical-Fiber Cables
2024-2011	Standard for Optical Fiber Raceways
2024-2014	Standard for Cable Routing Assemblies and Communications Raceways
2196-2001	Standard for Test of Fire Resistive Cable
60950-1 ed. 2-2014	Information Technology Equipment Safety

D. Industry Standards:

1. Advanced Television Systems Committee (ATSC):

A/53 Part 1: 2013	ATSC Digital Television Standard, Part 1, Digital Television System
A/53 Part 2: 2011	ATSC Digital Television Standard, Part 2, RF/Transmission System Characteristics
A/53 Part 3: 2013	ATSC Digital Television Standard, Part 3, Service Multiplex and Transport System Characteristics
A/53 Part 4: 2009	ATSC Digital Television Standard, Part 4, MPEG-2 Video System Characteristics
A/53 Part 5: 2014	ATSC Digital Television Standard, Part 5, AC-3 Audio System Characteristics
A/53 Part 6: 2014	ATSC digital Television Standard, Part 6, Enhanced AC-3 Audio System Characteristics

2. American Institute of Architects (AIA): 2006 Guidelines for Design & Construction of Health Care Facilities.

3. American Society of Mechanical Engineers (ASME):

A17.1 (2013)	Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices
17.3 (2011)	Safety Code for Existing Elevators and Escalators
17.4 (2009)	Guide for Emergency Personnel
17.5 (2011)	Elevator and Escalator Electrical Equipment

4. American Society for Testing and Materials (ASTM):

B1 (2001)	Standard Specification for Hard-Drawn Copper Wire
B8 (2004)	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
D1557 (2012)	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft3 (2,700 kN-m/m3)
D2301 (2004)	Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape
B258-02 (2008)	Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors
D709-01(2007)	Standard Specification for Laminated Thermosetting Materials
D4566 (2008)	Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable

5. American Telephone and Telegraph Corporation (AT&T) - Obtain following AT&T Publications at https://ebiznet.sbc.com/sbcnebs/

ATT-TP-76200 (2013)	Network Equipment and Power Grounding, Environmental, and Physical Design Requirements
ATT-TP-76300(2012)	Merged AT&T Affiliate Companies Installation Requirements
ATT-TP-76305 (2013)	Common Systems Cable and Wire Installation and Removal Requirements - Cable Racks and Raceways
ATT-TP-76306 (2009)	Electrostatic Discharge Control
ATT-TP-76400 (2012)	Detail Engineering Requirements
ATT-TP-76402 (2013)	AT&T Raised Access Floor Engineering and Installation Requirements
ATT-TP-76405 (2011)	Technical Requirements for Supplemental Cooling Systems in Network Equipment Environments
ATT-TP-76416 (2011)	Grounding and Bonding Requirements for Network Facilities
ATT-TP-76440 (2005)	Ethernet Specification
ATT-TP-76450 (2013)	Common Systems Equipment Interconnection Standards for AT&T Network Equipment Spaces
ATT-TP-76461 (2008)	Fiber Optic Cleaning
ATT-TP-76900 (2010)	AT&T Installation Testing Requirement
ATT-TP-76911 (1999)	AT&T LEC Technical Publication Notice

6. British Standards Institution (BSI):

BS EN 50109-2 Hand Crimping Tools - Tools for The Crimp Termination of Electric Cables and Wires for Low Frequency and Radio Frequency Applications – All Parts & Sections. October 1997

7. Building Industry Consulting Service International(BICSI):

ANSI/BICSI 002-2011 Data Center Design and Implementation Best Practices

ANSI/BICSI 004-2012 Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities

ANSI/NECA/BICSI 568-2006 Standard for Installing Commercial Building Telecommunications Cabling

NECA/BICSI 607-2011 Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

ANSI/BICSI 005-2013 Electronic Safety and Security (ESS) System Design and Implementation Best Practices

8. Electronic Components Assemblies and Materials Association,(ECA).

ECA EIA/RS-270 (1973)Tools, Crimping, Solderless Wiring Devices – Recommended Procedures for User Certification

EIA/ECA 310-E (2005) Cabinets, and Associated Equipment

9. Facility Guidelines Institute: 2010 Guidelines for Design and Construction of Health Care Facilities.

10. Insulated Cable Engineers Association (ICEA):

ANSI/ICEA S-80-576-2002 Category 1 & 2 Individually Unshielded Twisted-Pair Indoor Cables for Use in Communications Wiring Systems

ANSI/ICEA S-84-608-2010 Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor, S-87-640(2011) Optical Fiber Outside Plant Communications Cable

ANSI/ICEA S-90-661-2012 Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems

S-98-688 (2012) Broadband Twisted Pair Cable Aircore, Polyolefin Insulated, Copper Conductors

S-99-689 (2012) Broadband Twisted Pair Cable Filled, Polyolefin Insulated, Copper Conductors

ICEA S-102-700

(2004)	Category 6A Individually Unshielded Twisted Pair Indoor Cables (With or Without an Overall Shield) for use in Communications Wiring Systems Technical Requirements

11. Institute of Electrical and Electronics Engineers (IEEE):

ISSN 0739-5175	March-April 2008 Engineering in Medicine and Biology Magazine, IEEE (Volume: 27, Issue:2) Medical Grade-Mission Critical-Wireless Networks
IEEE C2-2012	National Electrical Safety Code (NESC)
C62.41.2-2002/ Cor 1-2012 IEEE	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 IEEE	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System
100-1992	IEEE the New IEEE Standards Dictionary of Electrical and Electronics Terms
602-2007	IEEE Recommended Practice for Electric Systems in Health Care Facilities
1100-2005	IEEE Recommended Practice for Powering and Grounding Electronic Equipment

12. International Code Council:

AC193 (2014)	Mechanical Anchors in Concrete Elements

13. International Organization for Standardization (ISO):

ISO/TR 21730 (2007)	Use of Mobile Wireless Communication and Computing Technology in Healthcare Facilities - Recommendations for Electromagnetic Compatibility (Management of Unintentional Electromagnetic Interference) with Medical Devices

14. National Electrical Manufacturers Association (NEMA):

NEMA 250 (2008)	Enclosures for Electrical Equipment (1,000V Maximum)
ANSI C62.61 (1993)	American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits
ANSI/NEMA FB 1 (2012)	Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing EMT) and Cable
ANSI/NEMA OS 1 (2009)	Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA SB 19 (R2007)	NEMA Installation Guide for Nurse Call Systems

TC 3 (2004)	Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
NEMA VE 2 (2006)	Cable Tray Installation Guidelines

15. National Fire Protection Association (NFPA):

70E-2015	Standard for Electrical Safety in the Workplace
70-2014	National Electrical Code (NEC)
72-2013	National Fire Alarm Code
75-2013	Standard for the Fire Protection of Information Technological Equipment
76-2012	Recommended Practice for the Fire Protection of Telecommunications Facilities
77-2014	Recommended Practice on Static Electricity
90A-2015	Standard for the Installation of Air Conditioning and Ventilating Systems
99-2015	Health Care Facilities Code
101-2015	Life Safety Code
241	Safeguarding construction, alternation and Demolition Operations
255-2006	Standard Method of Test of Surface Burning Characteristics of Building Materials
262 - 2011	Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
780-2014	Standard for the Installation of Lightning Protection Systems
1221-2013	Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
5000-2015	Building Construction and Safety Code

16. Society for Protective Coatings (SSPC):

SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

17. Society of Cable Telecommunications Engineers (SCTE):

ANSI/SCTE 15 2006	Specification for Trunk, Feeder and Distribution Coaxial Cable

18. Telecommunications Industry Association (TIA):

TIA-120 Series	Telecommunications Land Mobile communications (APCO/Project 25) (January 2014)
TIA TSB-140	Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems (2004)
TIA-155	Guidelines for the Assessment and Mitigation of Installed Category 6A Cabling to Support 10GBASE-T (2010)

TIA TSB-162-A	Telecommunications Cabling Guidelines for Wireless Access Points (2013)
TIA-222-G	Structural Standard for Antenna Supporting Structures and Antennas (2014)
TIA/EIA-423-B	Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits (2012)
TIA-455-C	General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components (August 2014)
TIA-455-53-A	FOTP-53 Attenuation by Substitution Measurements for Multimode Graded-Index Optical Fibers in Fiber Assemblies (Long Length) (September 2001)
TIA-455-61-A	FOTP-61 Measurement of Fiber of Cable Attenuation Using an OTDR (July 2003)
TIA-472D000-B	Fiber Optic Communications Cable for Outside Plant Use (July 2007)
ANSI/TIA-492-B	62.5-µ Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (November 2009)
ANSI/TIA-492AAAB-A	50-um Core Diameter/125-um Cladding Diameter Class IA Graded-Index Multimode Optically Optimized American Standard Fibers (November 2009
TIA-492CAAA	Detail Specification for Class IVa Dispersion- Unshifted Single-Mode Optical Fibers (September 2002)
TIA-492E000	Sectional Specification for Class IVd Nonzero- Dispersion Single-Mode Optical Fibers for the 1,550 nm Window (September 2002)
TIA-526-7-B	Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7 (December 2008)
TIA-526.14-A	Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – SFSTP-14 (August 1998)
TIA-568	Revision/Edition: C Commercial Building Telecommunications Cabling Standard Set: (TIA-568-C.0-2 Generic Telecommunications Cabling for Customer Premises (2012), TIA-568-C.1-1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements (2012), TIA-568-C.2 Commercial Building Telecommunications Cabling

	Standard—Part 2: Balanced Twisted Pair Cabling Components (2009), TIA-568-C.3-1 Optical Fiber Cabling Components Standard, (2011) AND TIA-568-C.4 Broadband Coaxial Cabling and Components Standard (2011) with addendums and erratas
TIA-569	Revision/Edition C Telecommunications Pathways and Spaces (March 2013)
TIA-574	Position Non-Synchronous Interface between Data Terminal equipment and Data Circuit Terminating Equipment Employing Serial Binary Interchange (May 2003)
TIA/EIA-590-A	Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant (July 2001)
TIA-598-D	Optical Fiber Cable Color Coding (January 2005)
TIA-604-10-B	Fiber Optic Connector Intermateablility Standard (August 2008)
ANSI/TIA-606-B	Administration Standard for Telecommunications Infrastructure (2012)
TIA-607-B	Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises (January 2013)
TIA-613	High Speed Serial Interface for Data Terminal Equipment and Data Circuit Terminal Equipment (September 2005)
ANSI/TIA-758-B	Customer-owned Outside Plant Telecommunications Infrastructure Standard (April 2012)
ANSI/TIA-854	A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6A Balanced Twisted-Pair Cabling (2001)
ANSI/TIA-862-A	Building Automation Systems Cabling Standard (April 2011)
TIA-942-A	Telecommunications Infrastructure Standard for Data Centers (March 2014)
TIA-1152	Requirements for Field Testing Instruments and Measurements for Balanced Twisted Pair Cabling (September 2009)
TIA-1179	Healthcare Facility Telecommunications Infrastructure Standard (July 2010)

1.4 SINGULAR NUMBER

A. Where any device or part of equipment is referred in singular number (such as " rack"), reference applies to as many such devices as are required to complete installation.

1.5 RELATED WORK

A. Specification Order of Precedence: FAR Clause 52.236-21, VAAR Clause 852.236-71.

1. Field Cutting and Patching: Section 09 91 00, PAINTING.

2. Additional submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
3. Availability and source of references and standards specified in applicable publications: Section 01 42 19, REFERENCE STANDARDS.
4. Control of environmental pollution and damage for air, water, and land resources: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
5. Requirements for non-hazardous building construction and demolition waste: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
6. General requirements and procedures to comply with various federal mandates and U.S. Department of Veterans Affairs (VA) policies for sustainable design: Section 01 81 13,SUSTAINABLE DESIGN REQUIREMENTS.
7. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction: Section 07 84 00, FIRESTOPPING.
8. Sealant and caulking materials and their application: Section 07 92 00, JOINT SEALANTS.
9. General electrical requirements that are common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
10. Electrical conductors and cables in electrical systems rated 600 V and below: Section 26 05 21, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
11. Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
12. Conduit and boxes: Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
13. Wiring devices: Section 26 27 26, WIRING DEVICES.
14. Underground ducts, raceways, precast manholes and pull boxes: Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.
15. Lightning protection: Section 26 41 00, FACILITY LIGHTNING PROTECTION.
16. General requirements common to more than one section in Division 28: Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.
17. Conductors and cables for electronic safety and security systems: Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY.
18. Low impedance path to ground for electronic safety and security system ground fault currents: Section 28 05 26, GROUNDING AND BONDING FOR SECURITY SYSTEMS.
19. Physical Access Control System field-installed controllers connected by data transmission network: Section 28 13 00, PHYSICAL ACCESS DETECTION.

20. Video surveillance system cameras, data transmission wiring, and control stations with associated equipment: Section 28 23 00, VIDEO SURVEILLANCE EQUIPMENT AND SYSTEMS.
21. Duress-panic alarms, emergency phones or call boxes, intercom systems, data transmission wiring and associated equipment: Section 28 26 00, ELECTRONIC PERSONAL PROTECTION EQUIPMENT AND SYSTEMS.
22. Alarm initiating devices, alarm notification appliances, control units, fire safety control devices, annunciators, power supplies, and wiring: Section 28 31 00, FIRE DETECTION AND ALARM.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Assign a single communications project manager to serve as point of contact for Government, contractor, and design professional.

B. Be proactive in scheduling work.

1. Use of premises is restricted at times directed by COR.
2. Movement of materials: Unload materials and equipment delivered to site. Pay costs for rigging, hoisting, lowering and moving equipment on and around site, in building or on roof.
3. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
4. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work. Plan for large equipment requiring positioning prior to closing in building.
5. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies; provide required connection for each service.
6. Initiate and maintain discussion regarding schedule for ceiling construction and install cables to meet that schedule.

C. Contact the Office of Telecommunications, Special Communications Team (005OP2H3) (202)461-5310 to have a Government-accepted Telecommunications COR assigned to project for telecommunications review, equipment and system approval and coordination with other VA personnel.

D. Communications Project Manager Responsibilities:

1. Assume responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and authorized system installers.
2. Coordinate with related work indicated on drawings or specified.
3. Manage work related to telecommunications system installation in a manner approved by manufacturer.

1.7 SUBMITTALS

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

B. Provide parts list including quantity of spare parts.

C. Provide manufacturer product information. Government reserves the right to require a list of installations where products have been in operation.

D. Provide Source Quality Control Submittal:

1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of warranty maintenance are authorized representatives of OEM. Include individual's legal name, contact information and OEM credentials in certification.
2. Submit written certification from OEM that wiring and connection diagrams meet Government Life Safety Guidelines, NFPA, NEC, NRTL, these specifications, and Joint Commission requirements and instructions, requirements, recommendations, and guidance set forth by OEM for the proper performance of system.
3. Pre-acceptance Certification: Certification in accordance with procedure outlined in Section 01 00 00, GENERAL REQUIREMENTS and specific Division 27 qualification documentation.

E. Installer Qualifications: Submit three installations of similar size and complexity furnished and installed by installer; include:

1. Installation location and name.
2. Owner’s name and contact information including, address, telephone and email.
3. Date of project start and date of final acceptance.
4. System project number.
5. Three paragraph description of each system related to this project; include function, operation, and installation.

F. Provide delegated design submittals (e.g. seismic support design).

G. Submittals are required for all equipment anchors and supports. Include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or conduit. Anchors and supports to resist seismic load based on seismic design categories per section 4.0 of VA seismic design requirements H-18-8 dated August, 2013.

H. Test Equipment List:

1. Supply test equipment of accuracy better than parameters to be tested.
2. Submit test equipment list including make and model number:
   a. ANSI/TIA-1152 Level IIIe twisted pair cabling test instrument.
   b. Fiber optic insertion loss power meter with light source.
   c. Optical time domain reflectometer (OTDR).
   d. Volt-Ohm meter.

e. Digital camera.

f. Bit Error Test Set (BERT).

g. Signal level meter.

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.

b. Building Entrance Facility/Demarcation rooms.

c. Server rooms/Data Center.

d. Equipment rooms.

e. Antenna Head End 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 .rvt 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, except as follows:

1. Warranty material and equipment to be free from defects, workmanship, and remain so for a period of one year for Emergency Systems from date of final acceptance of system by Government; provide OEM's equipment warranty document to COR.
2. Government maintenance personnel must have ability to contact OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time; contractor and OEM must provide this capability.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Provide communications spaces and pathways conforming to TIA 569, at a minimum.

B. In cases of renovations in historic or otherwise restrictive buildings, where it has been determined as impossible to follow above stated guidelines, exceptions must not modify maximum distances set forth in TIA 568 and 569; and exceptions must not in any way effect performance of entire TIP system.

C. Modification to administrative issues requires written approvals from COR with concurrence from SMCS 005OP2H3, OEM, contractor, and local authorities.

2.2 EQUIPMENT IDENTIFICATION

A. Provide laminated black phenolic resin with a white core nameplates with minimum 6 mm (1/4 inch) high engraved lettering.

B. Nameplates furnished by manufacturer as standard catalog items, unless other method of identification is indicated.

2.3 UNDERGROUND WARNING TAPE

A. Underground Warning: Standard 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type; red with black letters imprinted with "CAUTION BURIED ELECTRIC LINE BELOW", orange with black letters imprinted with "CAUTION BURIED TELEPHONE LINE BELOW" or orange with black letters imprinted with "CAUTION BURIED FIBER OPTIC LINE BELOW", as applicable.

2.4 WIRE LUBRICATING COMPOUND

A. Provide non-hardening or forming adhesive coating cable lubricants suitable for cable jacket material and raceway.

2.5 FIREPROOFING TAPE

A. Provide flexible, conformable fabric tape of organic composition and coated one side with flame-retardant elastomer.

B. Tape must be self-extinguishing and cannot support combustion; arc-proof and fireproof.

C. Tape cannot deteriorate when subjected to water, gases, salt water, sewage, or fungus; and tape must be resistant to sunlight and ultraviolet light.

D. Application must withstand a 200-ampere arc for minimum 30 seconds.

E. Securing Tape: Glass cloth electrical tape minimum 0.18 mm (7 mils) thick and 19 mm (3/4 inch) wide.

2.6 UNDERGROUND CABLES

A. Provide buried closure suitable for enclosing a straight, butt, and branch splice in a container into which can be poured an encapsulating compound.

B. Provide closure of adequate strength to protect splice and maintain cable shield electrical continuity in buried environment.

C. Provide re-enterable encapsulating compound maintaining chemical stability of closure.

D. Provide filled splice cases in accordance with RUS Bull 345-72.

E. Re-Enterable Encapsulating Compound: Product maintaining chemical stability of closure.

2.7 AERIAL (ABOVEGROUND) ENCLOSURES – NOT USED

2.8 TEMPORARY TIP PATHS (OVERHEAD TRACKS, ROAD/PATH BRIDGES) – NOT USED

2.9 ACCESS PANELS

A. Panels: 304 mm x 304 mm (12 inches by 12 inches), or size allowed by location to provide optimum access to equipment for maintenance and service.

B. Provide access panels and doors as required to allow service of materials and equipment that require inspection, replacement, repair or service.

C. Provide access panels where items installed require access and are concealed in floor, wall, furred space or above ceiling; ceilings consisting of lay-in or removable splined tiles do not require access panels.

D. Provide access panels with same fire rating classification as surface penetrated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Penetrations and Sleeves:

1. Lay out penetration and sleeve openings in advance, to permit provision in work.
2. Set sleeves in forms before concrete is poured.
3. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts.

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.

3.4 EQUIPMENT IDENTIFICATION

A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.

B. Secure identification signs with screws.

3.5 CUTTING AND PATCHING

A. Perform cutting and patching according to contract general requirements and as follows:

1. Remove samples of installed work as specified for testing.
2. Perform cutting, fitting, and patching of equipment and materials required to uncover existing infrastructure in order to provide access for correction of improperly installed existing or new work.
3. Remove and replace defective work.
4. Remove and replace non-conforming work.

B. Cut, remove, and legally dispose of selected equipment, components, and materials, including removal of material, equipment, devices, and other items indicated to be removed and items made obsolete by new work.

C. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.

D. Protect adjacent installations during cutting and patching operations.

E. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

F. Patch finished surfaces and building components using new materials specified for original installation and experienced installers.

3.6 FIELD QUALITY CONTROL

A. Provide work according to VAAR 852.236.91 and FAR clause 52.236-5.

B. Provide minimum clearances and work required for compliance with NFPA 70, National Electrical Code (NEC), and manufacturers' instructions; comply with additional requirements indicated for access and clearances.

C. Verify all field conditions and dimensions that affect selection and provision of materials and equipment, and provide any disassembly, reassembly, relocation, demolition, cutting and patching required to provide work specified or indicated, including relocation and reinstallation of existing wiring and equipment.
   1. Protect facility, equipment, and wiring from damage.
D. Submit written notice that:
   1. Project has been inspected for compliance with documents.
   2. Work has been completed in accordance with documents.
E. Non-Conforming Work: Conduct project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing and demonstrations after verification of system operation and completeness by Contractor.
F. For project acceptance inspections, final completion inspections, substantial completion inspections, and testing/demonstrations that require more than one site visit by COR or design professional to verify project compliance for same material or equipment, Government reserves right to obtain compensation from contractor to defray cost of additional site visits that result from project construction or testing deficiencies and incompleteness, incorrect information, or non-compliance with project provisions.
   1. COR will notify contractor, of hourly rates and travel expenses for additional site visits, and will issue an invoice to Contractor for additional site visits.
   2. Contractor is not be eligible for extensions of project schedule or additional charges resulting from additional site visits that result from project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.
G. Tests:
   1. Interim inspection is required at approximately 50 percent of installation.
   2. Request inspection ten working days prior to interim inspection start date by notifying COR in writing; this inspection must verify equipment and system being provided adheres to installation, mechanical and technical requirements of construction documents.
   3. Inspection to be conducted by OEM and factory-certified contractor representative, and witnessed by COR, facility and SMCS 0050P2H3 representatives.
   4. Check each item of installed equipment to ensure appropriate NRTL listing labels and markings are fixed in place.
   5. Verify cabling terminations in DEMARC, MCR, TER, SCC, ECC, TRs and head end rooms, workstation locations and TCO adhere to color code for T568B pin assignments and cabling connections are in compliance with TIA standards.
   6. Visually confirm minimum Category 6A cable marking at TCOs, CCSs locations, patch cords and origination locations.

7. Review entire communications circulating ground system, each TGB and grounding connection, grounding electrode and outside lightning protection system.
8. Review cable tray, conduit and path/wire way installation practice.
9. OEM and contractor to perform:
   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.
10. 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.
11. Provide results of interim inspections to COR.
12. 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.
13. 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 DAS RF, voice and data channel, at each of the following minimum points in system:
   a. Utility provider entrance.
   b. Buried conduit duct locations.

c. Maintenance Holes (Manholes) and hand holes.

d. ENTR or DEMARC.

e. PBX interconnections.

f. MCR interconnections.

g. MCOR interconnections.

h. TER interconnections.

i. TOR interconnections.

j. Control room interconnections.

k. TR interconnections.

l. System interfaces in locations listed herein.

m. HE interconnections.

n. Antenna (outside and inside) interconnections.

o. System and lightning ground interconnections.

p. Communications circulating ground system.

q. UPS areas.

r. Emergency generator interconnections.

s. Each general floor areas.

t. 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). Once items have been provided, COR contacts FMS service chief to turn over system from CFM oversight for beneficial use by facility.

3. If system is declared unacceptable without conditions, rescheduled testing expenses are to be borne by contractor.

3.7 CLEANING

A. Remove debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from project site and clean work area, prior to final inspection and acceptance of work.

B. Put building and premises in neat and clean condition.

C. Remove debris on a daily basis.

D. Remove unused material, during progress of work.

E. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of COR.

F. Clean exterior surface of all equipment, including concrete residue, dirt, and paint residue, after completion of project.

G. Perform final cleaning prior to project acceptance by COR.

H. Remove paint splatters and other spots, dirt, and debris; touch up scratches and mars of finish to match original finish.

I. Clean devices internally using methods and materials recommended by manufacturer.

J. Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. In absence of published connection or terminal torque values, comply with torque values specified in UL 486A-486B.

3.8 TRAINING

A. Provide training in accordance with subsection, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

B. Provide training for equipment or system as required in each associated specification.

C. Develop and submit training schedule for approval by COR, at least 30 days prior to planned training.

3.9 PROTECTION

A. Protection of Fireproofing:

1. Install clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed, if possible, prior to start of spray fireproofing work.
2. Install conduits and other items that would interfere with proper application of fireproofing after completion of spray fire proofing work.
3. Patch and repair fireproofing damaged due to cutting or course of work must be performed by installer of fireproofing and paid for by trade responsible for damage.

B. Maintain equipment and systems until final acceptance.

C. Ensure adequate protection of equipment and material during installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

- - - E N D - - -

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies grounding and bonding requirements of communications installations based on the requirements of ANSI/TIA-607-D, Telecommunications Bonding and Grounding (Earthing) for Customer Premises. Work covered by this Section shall consist of furnishing supplies, labor, materials, equipment, labeling, and tools. Testing is required unless otherwise specified. An operable grounding and bonding infrastructure is required as described on the Drawings and/or required by these specifications. All materials shall be listed by a nationally recognized testing laboratory (NRTL).

1.2 SUMMARY

Section Includes:

A. Required Bonding Busbars.

B. Supplemental Bonding Networks.

C. Telecommunications Bonding Conductors.

D. Joining Requirements.

E. Overvoltage Surge Protectors.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

B. ANSI/TIA-607-D, Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

C. NFPA 70, National Electrical Code (NEC).

D. International Annealed Copper Standard (IACS).

E. BICSI Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.

F. UL 497 & UL 497A, UL Standards for Primary & Secondary Safety Protectors for Paired-Conductor Communications Circuits.

1.4 RELATED WORK

A. Facility grounding and bonding requirements: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

1.5 SUBMITTALS

A. Provide riser diagram indicating location of communications grounding system connections indicating routing of grounding conductors.

B. 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.

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.

A. Common Requirements.
   1. Provided with holes for use with correctly-matched UL Listed two-hole lugs and hardware.
   2. Constructed of copper or copper alloy with a minimum of 95% conductivity when annealed.
   3. Annealed as specified by the International Annealed Copper Standard (IACS).
   4. Installation resulting in a maximum 4.0Ω to ground resistance measured from any point in the system.
   5. Installation is insulated from the mounting surface through the use of appropriate insulators.
   6. UL Listed.

B. Primary Bonding Busbar (PBB). The PBB is a dedicated extension of the building grounding electrode system for the telecommunications infrastructure. The PBB also serves as the central attachment point for Secondary Bonding Busbars (SBB) via Telecommunications Bonding Backbone (TBB).
   1. Pre-drilled copper with holes to accommodate lug mounting holes.
   2. Sized for current applications and future growth.
   3. Insulated from its supports.
   4. Electro-tin plated is acceptable.
   5. Maintain a 2” min clearance between busbar and finished wall.
   6. Size must be 0.25” thick by 4” wide by 20” length.

C. Secondary Bonding Busbar (SBB). The SBB is a common point of connection for telecommunications system and equipment bonding to a ground located in each Telecommunications Room.
   1. Pre-drilled holes to accommodate dual-lug mounting holes.
   2. 0.25” thick x 2” wide with varying length to be sized for current applications and future growth.
   3. Maintain a 2” min clearance between the finished wall and busbar.
   4. Copper or tin annealed copper.

D. 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.
   3. Size & material 0.75” wide x 19” length x 0.25” thick – Copper or tin annealed copper.

2.2 SUPPLEMENTAL BONDING NETWORKS.

Also known as Signal Reference Grids (SRGs), Mesh Bonding Networks (Mesh-BN), or Isolated Bonding Networks (IBNs), the requirements for supplemental bonding networks are not specified in this document. Supplemental bonding networks may not be used to replace a standards-compliant bonding infrastructure.

2.3 TELECOMMUNICATIONS BONDING BACKBONE (TBB).

The TBB bonds the facility Primary Bonding Busbar (PBB) to telecommunications space Secondary Bonding Busbars (SBBs).

A. Material. Stranded copper wire with a green jacket (or per NEC depending on size), run as a continuous conductor.

B. Size. The TBB shall be sized to meet the requirements of ANSI/TIA-607-D and will be as straight as practicable avoiding bends.

C. Bonding the TBB to the PBB and each SBB will require a UL Listed irreversible compression (crimp) dual-lug connector.

2.4 BONDING CONDUCTORS.

A. Telecommunications Equipment Bonding Conductor (TEBC). The TEBC connects the cabinets and racks in the telecommunications space to the space's bonding busbar (PBB or SBB).

1. Material. Stranded copper wire with a green jacket (or per NEC depending on size), run as a continuous conductor.

2. Size. The TBB shall be sized to meet the requirements of ANSI/TIA-607-D. The minimum size for the TEBC shall be AWG 6.

3. Bonding. Bonded to the telecommunications space bonding busbar (PBB or SBB) via a UL Listed two-hole compression lug. Rack Bonding Conductors (RBCs) are connected to the TEBC using UL Listed irreversible compression (crimp) connectors.

B. Rack Bonding Conductor (RBC). The RBC is a bonding conductor from the cabinet or Rack Bonding Busbar (RBB) to the Telecommunications Equipment Bonding Conductor (TEBC).

1. Material. Stranded copper wire with a green jacket run as a continuous conductor.

2. Size. The minimum size for the RBC shall be AWG 6.

3. Bonding. Bonded to the Telecommunications Equipment Bonding Conductor (TEBC) using UL Listed irreversible compression (crimp) connectors.

a. Where connected to a server cabinet, the RBC extends to the bottom of the server cabinet allowing Equipment Bonding Conductors to be attached at any point in the cabinet.

b. Where connected to a network rack/cabinet, the Rack Bonding Conductor (RBC) is bonded to the Rack Bonding Busbar (RBB) via a UL Listed two-hole compression lug.

C. Equipment/Unit Bonding Conductor (EBC/UBC). The Equipment/Unit Bonding Conductor connects individual equipment in a cabinet or rack to the Rack Bonding Conductor (RBC) or Rack Bonding Busbar (RBB). Equipment Bonding conductors are also used as cable tray bonding conductors to bond cable tray sections to the Telecommunications Equipment Bonding Conductor (TEBC).

1. Material. Stranded copper wire with a green jacket run as a continuous conductor.

2. Size. The minimum size for the RBC shall be AWG 6.

3. Bonding.

a. Where used in a server cabinet, bonded to the Rack Bonding Connector (RBC) using UL Listed irreversible compression (crimp) connectors and to IT equipment via a UL Listed two-hole compression lug. (Some IT equipment may require one-hole lugs.)

b. Where used in a network cabinet/rack, bonded to the Rack Bonding Busbar (RBB) via a UL Listed two-hole compression lug and to IT equipment via a UL Listed two-hole compression lug. (Some IT equipment may require one-hole lugs.)

c. Where used as a cable tray bonding conductor connecting cable tray sections, bonded to each adjoining section of the cable tray using UL Listed two-hole compression lugs.

d. Where used as a cable tray bonding conductor connecting cable tray sections to the Telecommunications Equipment Bonding Conductor (TEBC), bonded to the TEBC using UL Listed irreversible compression (crimp) connectors and to the cable tray via a UL Listed two-hole compression lug.

4. Contractor shall furnish a minimum of ten (10) EBCs for each RBB. Five (5) EBCs shall be outfitted as described here and shall be six (6) feet in length. Five (5) EBCs shall be outfitted as decried here and shall be nine (9) feet in length. Contractor shall use field measurements to determine EBC cable length when directed by VA project managers.

2.5 OVERVOLTAGE SURGE PROTECTORS.

A. Protectors are voltage-limiting devices intended to protect equipment, wiring, and personnel against the effects of excessive potentials and currents in communications lines caused by lightning, contacts with power conductors, power induction, and rises in ground potential.

1. Compliance. Protectors shall be compliant with UL 497 and/or UL 497A, as applicable.
2. Performance. Protectors shall be rated to support copper UTP performance Category 6A at 100MHz.
3. Protection. Voltage suppression shall be via low capacitance solid state protectors only, rated at 18V for copper backbone applications or 65V for VOIP or PoE applications.
4. Construction. Provide protection for each pair.
5. Termination shall be insulation-displacement contact.
6. Mounting. Protectors shall be wall-mounted.

PART 3 - EXECUTION

3.1 IMPLEMENTATION

A. Components of the telecommunications bonding system will be installed and connected using materials and techniques required by ANSI/TIA-607-D. The use of antioxidant joint compound is required for all connections excluding protector 110 block connections.

B. Testing.

1. Perform tests per BICSI Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.
2. Perform two-point bond test using trained installers qualified to use test equipment.

3. Conduct continuity tests to verify that metallic pathways in telecommunications spaces are bonded to PBB or SBB.
4. Conduct electrical continuity test to verify that PBB is effectively bonded to the facility grounding electrode conductor.
5. Perform resistance tests to ensure rack and cabinet bonding connection resistance measures less than 4Ω to PBB or SBB.

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SECTION 27 05 33
CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies conduit, fittings, and boxes to form raceway systems for communications cabling.

1.2 RELATED WORK

A. Bedding of conduits: Section 31 20 00, EARTHWORK.

B. Sealing around penetrations to maintain integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.

C. Fabrications for deflection of water away from building envelope at penetrations: Section 07 60 00, FLASHING AND SHEET METAL.

D. Sealing around conduit penetrations through building envelope to prevent moisture migration into building: Section 07 92 00, JOINT SEALANTS.

E. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.

F. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.3 SUBMITTALS – NOT USED

PART 2 - PRODUCTS

2.1 MATERIAL

A. Minimum Conduit Size: 19 mm (3/4 inch).

B. Conduit:

1. Rigid Galvanized Steel: Conform to UL 6, ANSI C80.1.
2. Rigid Aluminum: Conform to UL 6A, ANSI C80.5.
3. Rigid Intermediate Steel Conduit (IMC): Conform to UL 1242, ANSI C80.6.
4. Electrical Metallic Tubing (EMT):
   a. Maximum Size: 105 mm (4 inches).
   b. Install only for cable rated 600 volts or less.
   c. Conform to UL 797, ANSI C80.3.
5. Flexible Galvanized Steel Conduit: Conform to UL 1.
6. Liquid-tight Flexible Metal Conduit: Conform to UL 360.
7. Direct Burial Plastic Conduit: Conform to UL 651 and UL 651A, heavy wall PVC, or high density polyethylene (HDPE).
8. Surface Metal Raceway: Conform to UL 5.

C. Conduit Fittings:

1. Rigid Galvanized Steel and Rigid Intermediate Steel Conduit Fittings:
   a. Provide fittings meeting requirements of UL 514B and ANSI/ NEMA FB 1.

b. Sealing: Provide threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water and vapor. In concealed work, install sealing fittings in flush steel boxes with blank cover plates having same finishes as other electrical plates in room.

c. Standard Threaded Couplings, Locknuts, Bushings, and Elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.

d. Locknuts: Bonding type with sharp edges for digging into metal wall of an enclosure.

e. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into metallic body of fitting. Bushings made entirely of metal or nonmetallic material are not permitted.

f. Erickson (union-type) and Set Screw Type Couplings:

1) Couplings listed for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete.

2) Use set screws of case hardened steel with hex head and cup point to seat in conduit wall for positive ground.

g. Provide OEM approved fittings.

2. Rigid Aluminum Conduit Fittings:

a. Standard Threaded Couplings, Locknuts, Bushings, and Elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are not permitted.

b. Locknuts and Bushings: As specified for rigid steel and IMC conduit.

c. Set Screw Fittings: Not permitted for use with aluminum conduit.

3. Electrical Metallic Tubing Fittings:

a. Conform to UL 514B and ANSI/ NEMA FB1; only steel or malleable iron materials are acceptable.

b. Couplings and Connectors: Concrete tight and rain tight, with connectors having insulated throats.

1) Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller.

2) Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches).

3) Use set screws of case-hardened steel with hex head and cup point to seat in wall of conduit for positive grounding.

c. Indent type connectors or couplings are not permitted.

d. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are not permitted.

e. Provide OEM approved fittings.

4. Flexible Steel Conduit Fittings:
   a. Conform to UL 514B; only steel or malleable iron materials are acceptable.
   b. Provide clamp type, with insulated throat.
   c. Provide OEM approved fittings.
5. Liquid-tight Flexible Metal Conduit Fittings:
   a. Conform to UL 514B and ANSI/ NEMA FB1; only steel or malleable iron materials are acceptable.
   b. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening.
   c. Provide connectors with insulated throats to prevent damage to cable jacket.
   d. Provide OEM approved fittings.
6. Direct Burial Plastic Conduit Fittings: Provide fittings meeting requirements of UL 514C and NEMA TC3, and as recommended by conduit manufacturer.
7. Expansion and Deflection Couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate 19 mm (3/4 inch) deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections.
   c. Include internal flexible metal braid sized to ensure conduit ground continuity and fault currents in accordance with UL 467, and NEC code tables for ground conductors.
   d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.
8. Rigid Aluminum Fittings:
   a. Provide malleable iron, steel or aluminum alloy materials; zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
   b. Locknuts and Bushings: As specified for rigid steel and IMC conduit.
   c. Set Screw Fittings: Not permitted for use with aluminum conduit.
   d. Indent type connectors or couplings are prohibited.
   e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of “pot metal” are not permitted.
   f. Provide OEM approved fittings.

D. Conduit Supports:
1. Parts and Hardware: Provide zinc-coat or equivalent corrosion protection.
2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

3. Multiple Conduit (Trapeze) Hangers: Minimum 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 2.78 mm (12 gage) steel, cold formed, lipped channels; with minimum 9 mm (3/8 inch) diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Splice, and Pull Boxes:
1. Conform to UL-50 and UL-514A.
2. Cast metal where required by NEC or shown, and equipped with rustproof boxes.
3. Sheet Metal Boxes: Galvanized steel, except where otherwise shown.
4. Install flush mounted wall or ceiling boxes with raised covers so that front face of raised cover is flush with wall.
5. Install surface mounted wall or ceiling boxes with surface style flat or raised covers.

F. Warning Tape: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, red with black letters, and imprinted with “CAUTION BURIED COMMUNICATIONS CABLE BELOW”.

G. Flexible Nonmetallic Communications Raceway (Innerduct) and Fittings:
1. General: Provide UL 910 listed plenum, riser, and general purpose corrugated pliable communications raceway.
2. Provide Communications Raceway with a factory installed 567 kg (1250 lb.) tensile pre-lubricated pull tape.
3. Use only metallic straps, hangers and fittings to support raceway from building structure. Cable ties are not permitted for securing raceway to building structure.
4. Provide fittings to be installed in spaces used for environmental air made of materials that do not exceed flammability, smoke generation, ignitibility, and toxicity requirements of environmental air space.
5. Size: Metric Designator 53 (trade size 2) or smaller.
6. Outside Plant: Plenum-rated where each innerduct is 75 mm (3 inches) and larger.
7. Inside Plant: Listed and marked for installation in plenum airspaces and minimum 25 mm (1 inch) inside diameter.
8. Plenum: Non-metallic communications raceway.
   a. Constructed of low smoke emission, flame retardant PVC with corrugated construction.
   b. UL 94 V-O rating for flame spreading limitation.
9. Provide innerduct reel lengths as necessary to ensure ducts are continuous.
10. Provide pulling accessories used for innerduct, inner duct lubricants, spreaders, applicators, grips, swivels, harnesses, and line missiles (blown air) compatible with materials being pulled.

H. Outlet Boxes:

1. Flush wall mounted minimum 11.9 cm (4-11/16 inches) square, 9.2 cm (3-5/8 inches) deep pressed galvanized steel.
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.

I. Weatherproof Outlet Boxes: Surface mount two gang, 67 mm (2-5/8 inches) deep weatherproof cast aluminum with powder coated finish internal threads on hubs 19 mm (3/4 inch) minimum.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Penetrations:
   1. Cutting or Holes:
      a. Locate holes in advance of installation. Where proposed in structural sections, obtain approval of structural engineer and COR prior to drilling through structural sections.
      b. Make holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not permitted; COR may grant limited permission by request, in condition of limited working space.
      c. Fire Stop: Where conduits, wireways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.
         1) Fill and seal clearances between raceways and openings with fire stop material.
         2) Install only retrofittable, non-hardening, and reusable firestop material that can be removed and reinstalled to seal around cables inside conduits.
      d. Waterproofing at Floor, Exterior Wall, and Roof Conduit Penetrations: Seal clearances around conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS or directed by waterproofing manufacturer.

B. Conduit Installation:
   1. Minimum conduit size of 19 mm (3/4 inch), but not less than size required for 40 percent fill.
   2. Install insulated bushings on all conduit ends.
   3. Install pull boxes after every 180 degrees of bends (two 90-degree bends) or every 100ft. Size boxes per TIA 569.
   4. Extend vertical conduits/sleeves through floors minimum 75 mm (3 inches) above floor and minimum 75 mm (3 inches) below ceiling of floor below.

5. Terminate conduit runs to and from a backboard in a TR or interstitial space at top or bottom of backboard. Install conduits to enter telecommunication rooms next to wall and flush with backboard.
6. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections.
7. Seal empty conduits located in telecommunications rooms or on backboards to prevent entrance of moisture and gases and to meet fire resistance requirements.
8. Provide pull wire in all empty conduits; sleeves through floor are exceptions.
9. Complete each entire conduit run installation before pulling in cables.
10. Flattened, dented, or deformed conduit is not permitted.
11. Ensure conduit installation does not encroach into ceiling height head room, walkways, or doorways.
12. Cut conduit square with a hacksaw, ream, remove burrs, and draw tight.
13. Install conduit mechanically continuous.
14. Independently support conduit at 2.44 m (8 feet) on center; do not use other supports (i.e., suspended ceilings, suspended ceiling supporting members, luminaires, conduits, mechanical piping, or mechanical ducts).
15. Support conduit within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
16. Close ends of empty conduit with plugs or caps to prevent entry of debris, until cables are pulled in.
17. Conduit installations under fume and vent hoods are prohibited.
18. 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.
19. Do not use aluminum conduits in wet locations.
20. Unless otherwise indicated on drawings or specified herein, conceal conduits within finished walls, floors and ceilings.
21. Conduit Bends:
    a. Make bends with standard conduit bending machines; observe minimum bend radius for cable type and outside diameter.
    b. Conduit hickey is permitted only for slight offsets, and for straightening stubbed conduits.
    c. Bending of conduits with a pipe tee or vise is not permitted.
    d. Minimum radius of communication conduit bends:

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

22. Layout and Homeruns - Deviations: Make only where necessary to avoid interferences and only after drawings showing proposed deviations have been submitted and approved by COR.

C. Concealed Work Installation:

1. In Concrete:

a. Conduit: Rigid steel or IMC.

b. Align and run conduit in direct lines.

c. Install conduit through concrete beams only when the following occurs:

1) Where shown on structural drawings.

2) As accepted by COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

d. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.

1) Conduit outside diameter larger than 1/3 of slab thickness is prohibited.

2) Space between Conduits in Slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.

3) Install conduits approximately in center of slab to ensure a minimum of 19 mm (3/4 inch) of concrete around conduits.

e. Make couplings and connections watertight. Use thread compounds that are NRTL listed conductive type to ensure low resistance ground continuity through conduits. Tightening set screws with pliers is not permitted.

D. Furred or Suspended Ceilings and in Walls:

1. Rigid steel, IMC or rigid aluminum. Different type conduits mixed indiscriminately in same system is not permitted.

2. Align and run conduit parallel or perpendicular to building lines.

3. Tightening set screws with pliers is not permitted.

E. Exposed Work Installation:
   1. Unless otherwise indicated on drawings, exposed conduit is only permitted in telecommunications rooms.
      a. Provide rigid steel, IMC or rigid aluminum.
      b. Different type of conduits mixed indiscriminately in system is not permitted.
   2. Align and run conduit parallel or perpendicular to building lines.
   3. Install horizontal runs close to ceiling or beams and secure with conduit straps.
   4. Support horizontal or vertical runs at not over 2400 mm (96 inches) intervals.
   5. Painting:
      a. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
      b. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color.
      c. Provide labels where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.
F. Expansion Joints:
   1. Conduits 75 mm (3 inches) and larger, that are secured to building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install couplings in accordance with manufacturer's recommendations.
   2. Provide conduits smaller than 75 mm (3 inches) with pull boxes on both sides of expansion joint. Connect conduits to expansion and deflection couplings as specified.
   3. Install expansion and deflection couplings where shown.
G. Seismic Areas:
   1. In seismic areas, follow H-18-8 Seismic Design Requirements.
   2. Rigidly secure conduit to building structure on opposite sides of a building expansion joint with pull boxes on both sides of joint.
   3. Connect conduits to pull boxes with 375 mm (15 inches) of slack flexible conduit.
   4. Install green copper wire minimum #6 AWG in flexible conduit for bonding jumper.
H. Conduit Supports, Installation:
   1. Select AC193 code listed mechanical anchors or fastening devices with safe working load not to exceed 1/4 of proof test load.
   2. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
   3. Support multiple conduit runs with trapeze hangers. Use trapeze hangers designed to support a load equal or greater than sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other accepted fasteners.
   4. Support conduit independent of pull boxes, luminaires, suspended ceiling components, angle supports, duct work, and similar items.
   5. Fastenings and Supports in Solid Masonry and Concrete:

a. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing concrete.

b. Existing Construction:

1) Code AC193 listed wedge type steel expansion anchors minimum 6 mm (1/4 inch) bolt size and minimum 28 mm (1-1/8 inch) embedment.

2) Power set fasteners minimum 6 mm (1/4 inch) diameter with depth of penetration minimum 75 mm (3 inches).

3) Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

6. Fastening to Hollow Masonry: Toggle bolts are permitted.

7. Fastening to Metal Structures: Use machine screw fasteners or other devices designed and accepted for application.

8. Bolts supported only by plaster or gypsum wallboard are not acceptable.

9. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

10. Do not support conduit from chain, wire, or perforated strap.

11. Spring steel type supports or fasteners are not permitted except horizontal and vertical supports/fasteners within walls.

12. Vertical Supports:

a. Install riser clamps and supports for vertical conduit runs in accordance with NEC.

b. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

I. Box Installation:

1. Boxes for Concealed Conduits:

a. Flush mounted.

b. Provide raised covers for boxes to suit wall or ceiling, construction and finish. In spaces not controlled by VA (i.e., common hallways) covers must be lockable.

2. In addition to boxes shown, install additional boxes where needed to prevent damage to cables during pulling.

3. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

4. Stencil or install phenolic nameplates on covers of boxes identified on riser diagrams; for example "SIG-FA JB No. 1".

5. Outlet boxes mounted back-to-back in same wall are not permitted. A minimum 600 mm (24 inches) center-to-center lateral spacing must be maintained between boxes.

J. Flexible Nonmetallic Communications Raceway (Innerduct), Installation:

1. Install Innerduct in cable tray. Innerduct may not be free-hung.

2. Install only in accessible spaces not subject to physical damage or corrosive influences.
3. Make bends manually to assure internal diameter of tubing is not effectively reduced.
4. Extend each segment of innerduct minimum 300 mm (12 inches) beyond end of service conduit tie or cable tray. Restrain innerduct ends with wall mount clamps and seal when cable is installed.

3.2 TESTING

A. Examine fittings and locknuts for secureness.

B. Test RMC, IMC and EMT systems for electrical continuity and resistance to ground.

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SECTION 27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies labeling and identification requirements for information technology (IT) equipment cabinets, racks, and cabling.

1.2 SUMMARY

Section Includes:

A. Equipment and component labels.

B. Labeling implementation requirements.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK: - NOT USED.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND COMPONENT LABELS.

A. Materials. Materials used for labeling equipment, components, and telecommunications cabling shall be appropriate for the installation environment, durable and permanent, and heat-resistant if necessary for labeling in high-temperature environments.

PART 3 - EXECUTION

3.1 IMPLEMENTION:

A. Governing Standard. Labeling and identification of equipment, components, and telecommunications cabling shall be based on ANSI/TIA-606-C, Administration Standard for Telecommunications Infrastructure, and NFPA 70, National Electrical Code, as modified by guidance in the VA Infrastructure Standard for Telecommunications Spaces.

B. All passive infrastructure equipment, components, and telecommunications cabling installed shall be labeled at the time of installation.

C. Telecommunications cable labeling shall include delivery of complete and accurate connection documentation (where each cable terminates at each end) matching the installed labels.

D. Label locations shall be as specified in the VA Infrastructure Standard for Telecommunications Spaces.

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SECTION 27 10 00
STRUCTURED CABLING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for telecommunications structured cabling systems.

1.2 SUMMARY

Section Includes:

A. Computer Room Backbone Structured Cabling.
B. Computer Room Horizontal Structured Cabling.
C. Facility Backbone Structured Cabling.
D. Facility Horizontal Structured Cabling.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Cabling labeling and identification: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS: NOT USED

PART 2 - PRODUCTS

2.1 COMPUTER ROOM BACKBONE STRUCTURED CABLING.

Backbone structured cabling in the computer room environment (first level backbone) connects the Main Distribution Areas (MDAs) to the Horizontal Distribution Areas (HDAs).

A. Install first level backbone structured cabling in overhead cable tray and fiber raceway systems following diverse path routing.
B. All cabling used shall be pre-terminated and procured to the specific length required by the design (horizontal and vertical paths) with no more than 1 meter of excess length on each end.
C. Terminate first level backbone structured cabling in the top RU positions of each network rack , working downward, with patch panel equipment mounted on the front rails.
D. Mirror distribution on the A-side and B-side MDA and HDA elements.
    1. In MDA network racks :
        a. Install angled UTP patch panel(s) for each backbone UTP patch panel in the same-side HDA in the computer room beginning in RU45.
        b. Install an angled panel cover on the lowest UTP patch panel.
        c. Install a blanking panel in the RU below the UTP patch panels.
        d. Install fiber optic distribution cabinets to support the backbone fiber distribution from each HDA.

e. Install a blanking panel in the RU below the fiber optic distribution cabinet(s).

2. In HDA network racks :

a. Install fiber optic distribution cabinet(s) and populate with fiber optic distribution cassettes starting in RU45.

b. Install a blanking panel in the RU below the last fiber cabinet.

c. Install UTP patch panel(s) below the blanking panel.

d. Install a blanking panel in the RU below the last UTP patch panel.

E. Install UTP cables between the same-side MDAs and HDAs.

F. Install 12- or 24-strand multimode fiber optic cables between each fiber cassette in the HDA to either the same-side MDA or the opposite side MDA as appropriate.

2.2 COMPUTER ROOM HORIZONTAL STRUCTURED CABLING.

Horizontal structured cabling in the computer room environment connects the Equipment Distributors (EDs) in the server cabinets to each supported Horizontal Distribution Area (HDA).

A. Install horizontal structured cabling in overhead cable tray and fiber raceway systems following diverse path routing.

B. All cabling used shall be pre-terminated and procured to the specific length required by the design (horizontal and vertical paths) with no more than 1 meter of excess length on each end.

C. In the server cabinets, terminate horizontal structured cabling in EDs located in the top 5U of each cabinet, with patch panel equipment mounted on the rear rails.

1. Install fiber optic distribution cabinet(s) starting in RU45 and populate with fiber optic distribution cassettes to support the requirement.

2. Install a blanking panel in the RU below the last fiber cabinet.

3. Install copper UTP patch panel(s) below the blanking panel.

D. In the HDAs, terminate horizontal structured cabling in the RU positions immediately below the first level backbone structured cabling equipment of each network rack , working downward, with patch panel equipment mounted on the front rails.

1. Install fiber optic distribution cabinet(s) and populate with fiber optic distribution cassettes to support each server cabinet.

2. Install a blanking panel in the RU below the fiber optic distribution cabinet(s).

E. Install 12- or 24-strand multimode fiber optic cables between the server cabinet ED and both HDAs.

F. Install UTP cables between the server cabinet ED and both HDAs.

2.3 FACILITY BACKBONE STRUCTURED CABLING.

Backbone structured cabling (inter-building and intra-building first level backbone) connects the Entrance Rooms to the Main Distribution Areas (MDAs) in the computer room, and connects the Main Distribution Areas to each Telecommunications Room (TR). This specification describes facility backbone structured

cabling when the Entrance Rooms and computer room are in the same building, connected entirely by environmentally conditioned pathways (no outside plant pathways are transited).

A. Interior to each telecommunications space, install facility backbone structured cabling in overhead cable tray and fiber raceway systems.
B. All facility backbone structured cabling shall be redundant and follow diverse path routing.
C. Facility backbone cabling shall be field-terminated (fusion spliced).
D. In the Entrance Room, MDA, and TR network racks designated for facility backbone distribution, install fiber optic distribution cabinets as required for the quantity of fibers installed.
E. Between each Entrance Room and the computer room:
    1. Provide 2 diversely routed paths of backbone cabling from each Entrance Room. One path will terminate on the A-side MDA and one path will terminate on the B-side MDA.
    2. Install a minimum of 24 strands of multimode fiber optic cabling and 12 strands of single-mode fiber optic cabling per path.
    3. Populate the fiber optic distribution cabinets on each end with a sufficient quantity of multimode OM4 and single-mode OS1 fiber optic splice cassettes per path.
F. Between each MDA and each TR:
    1. No zone/intermediate distribution areas (ZDAs/IDAs) intermediate cross-connects (ICCs) shall be used. All facility backbone cabling between the MDAs and TRs shall be run directly and continuously.
    2. Provide 2 diversely routed paths of backbone cabling, one from the A-side MDA and one from the B-side MDA.
    3. Where the TR is located in the same building as the computer room MDAs (does not transit outside plant pathways) and the path distance is less than 400 meters, install a minimum of 24 strands of multimode fiber optic cabling and 12 strands of single-mode fiber optic cabling per path.
        a. Populate the fiber optic distribution cabinets on each end with a sufficient quantity of multimode OM4 and single-mode OS1 fiber optic splice cassettes per path.
    4. Where the TR is located in a different building as the computer room (transits outside plant pathways) or the path distance is greater than 400m, install a minimum of 24 strands of single-mode fiber optic cabling per path.
        a. Populate the fiber optic distribution cabinets on each end with a sufficient quantity of single-mode OS2 fiber optic splice cassettes per path.

2.4 FACILITY HORIZONTAL STRUCTURED CABLING.

Facility horizontal structured cabling (horizontal distribution) connects the Telecommunications Room (TR) to each end-user Work Area Outlet (WAO).

A. Interior to each TR, install horizontal distribution structured cabling in overhead cable tray systems.
B. All horizontal distribution structured cabling shall have a minimum of 2 cables per WAO.
C. Horizontal distribution structured cabling may be field-terminated.
D. In each TR install sufficient UTP patch panels to support the quantity of WAOs in the TR's serving zone.
    1. Plan network racks such that patch panels and horizontal cable managers are located in the top 1/3 (RU31-45), switching equipment in the middle 1/3 (RU16-30), and power distribution and other services in the bottom 1/3 (RU1-15).
E. Install a minimum of 2 UTP cables between the TR UTP patch panels and each work area faceplate.
F. Each typical end-user receptacle shall be constructed of a single-gang workbox with one connector chassis, a minimum of two non-proprietary Category 6A 8P8C media interface connectors (RJ-45), and a four-position keystone faceplate.
    1. Modular plug terminated links (MPTL) are permitted to service wireless access points (WAPs), cameras, and other Power over Ethernet (PoE) devices where mating will be very infrequent.

PART 3 - EXECUTION

3.1 IMPLEMENTION:

A. 100% construction drawing sets shall include drawings detailing the computer room and facility/campus structured cabling systems, including:
    1. Cable media performance categories for each type of run.
    2. Cabling and equipment quantities.
    3. Elevation drawings showing equipment placement in individual enclosures.
    4. Full interconnection diagram for all structured cabling.
    5. Port map and cable label matrices.
B. All cabling and equipment shall be labeled per the requirements of the VA Infrastructure Standard for Telecommunications Spaces.

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SECTION 27 13 13
COMMUNICATIONS COPPER BACKBONE CABLING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for telecommunications copper (UTP) backbone and horizontal cabling in structured cabling systems in computer rooms.

1.2 SUMMARY

Section Includes:

A. Copper (UTP) Backbone Cables.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Computer room structured cabling: Section 27 10 00, STRUCTURED CABLING.

B. Cable labeling requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS: NOT USED

PART 2 - PRODUCTS

2.1 COPPER (UTP) BACKBONE CABLES.

Copper (UTP) backbone and horizontal cables are used in computer room structured cabling to connect Main Distribution Areas (MDAs), Horizontal Distribution Areas (HDAs), and server cabinet Equipment Distributors (EDs).

A. Performance Category. Copper (UTP) backbone cables shall meet the Category 6A performance requirements. Category 6A connectors are required.

B. Performance Specifications. Meets or exceeds TIA-EIA-568-C.2-10 and TSB-155.

C. Limited Power (LP) Certification. UL Listed as x-LP (0.5A).

D. Termination. Factory pre-terminated TIA 568B.

E. Testing. Factory certified to meet performance category requirements per TIA 568-C.2.

F. Conductor Size. 22-24AWG.

G. Jacket Rating. Communications Multipurpose Cable, Plenum (CMP) shall be specified if any portion of the cable passes through an NEC-defined plenum. Communications Multipurpose Cable, Riser (CMR) shall be specified for all other applications. CMP may be used as a substitute for CMR.

H. Bundling and Construction. Copper (UTP) backbone cables shall be provided in 6-cable bundles with individual 8P8C media interface connectors (RJ-45 ‘jacks’) or 6-jack cassettes designed to fit in copper (UTP) patch panels.

I. Color. A-side 8P8C media interface connectors (RJ-45) shall be blue. B-side 8P8C connectors shall be yellow.

J. Length. Backbone cabling used shall be procured to the specific length required by the design (horizontal and vertical paths) with no more than 2 feet of excess length.

PART 3 - EXECUTION

3.1 IMPLEMENTATION.

A. A. All cabling and equipment shall be labeled per the requirements of the VA Infrastructure Standard for Telecommunications Spaces.

B. Install first level backbone and horizontal structured cabling in the computer room in cable tray and fiber raceway systems following diverse path routing.

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SECTION 27 15 00
COMMUNICATIONS STRUCTURED CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies a complete and operating voice and digital structured cabling distribution system and associated equipment and hardware to be installed in VA Library here-in-after referred to as the “facility”.

1.2 RELATED WORK

A. Wiring devices: Section 26 27 26, WIRING DEVICES.

B. Lightning protection system: Section 26 41 00, FACILITY LIGHTNING PROTECTION.

C. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

D. 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.

E. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

F. Low voltage cabling system infrastructure: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.

1.3 SUBMITTALS

A. In addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS provide:

1. Pictorial layout drawing of each voice (telephone) equipment room, Demarc room, telecommunications room, showing termination cabinets, each distribution cabinet and rack, as each is expected to be installed and configured.
2. List of test equipment as per 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. Certifications:

1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of contract maintenance are authorized representatives of OEM. Include individual's legal name and address and OEM warranty credentials in the certification.
2. Pre-acceptance Certification: Submit in accordance with test procedures.
3. Test system cables and certify to COR before proof of performance testing can be conducted. Identify each cable as labeled on as-installed drawings.
4. Provide current and qualified test equipment OEM training certificates and product OEM installation certification for contractor installation, maintenance, and supervisory personnel.

C. Closeout Submittal: Provide document from OEM certifying that each item of equipment installed conforms to OEM published specifications.

1.4 WARRANTY

A. Work subject to terms of Article "Warranty of Construction," FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Provide complete system including “punch down” and cross-connector blocks voice and data distribution sub-systems, and associated hardware including telecommunications outlets (TCO); copper and fiber optic distribution cables, connectors, “patch” cables, “break out” devices and equipment cabinets, interface cabinets, and radio relay equipment rack.

B. Industry Standards:

1. Cable distribution systems provided under this section are connected to systems identified as critical care performing life support functions.
2. Conform to National and Local Life Safety Codes (whichever are more stringent), NFPA, NEC, this section, Joint Commission Life Safety Accreditation requirements, and OEM recommendations, instructions, and guidelines.
3. Provide supplies and materials listed by a nationally recognized testing laboratory where such standards are established for supplies, materials or equipment.
4. Refer to industry standards and minimum requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and guidelines listed.
5. Active and passive equipment required by system design and approved technical submittal; must conform to each UL standard in effect for equipment, when technical submittal was reviewed and approved by Government or date when COR accepted system equipment to be replaced. Where a UL standard is in existence for equipment to be used in completion of this contract, equipment must bear approved NRTL label.

C. System Performance: Provide complete system to meet or exceed TIA Category 6Arequirements.

D. Provide continuous inter- and/or intra-facility voice, data, and analog service.

1. Provide voice and data cable distribution system based on a physical “Star" topology.
2. Provide separate cable distribution system for emergency, safety and protection systems (i.e. emergency bypass phones; police emergency voice communications from parking lots and stairwells personal protection, duress alarms and annunciation systems;)
3. Contact SMCS 005OP2H3 (202-462-5310) for specific technical assistance and approvals.

E. Specific Subsystem Requirements: Provide products necessary for a complete and functional voice, data, analog and videotele communications cabling system, including backbone cabling system, patch panels and cross-connections, horizontal cabling systems, jacks, faceplates, and patch cords.

F. Coordinate size and type of conduit, pathways and firestopping for maximum 40 percent cable fill with subcontractors.

G. Terminate all interconnecting twisted pair, fiber-optic or coaxial cables on patch panels or punch blocks. Terminate unused or spare conductors and fiber strands. Do not leave unused or spare twisted pair wire, fiber-optic or coaxial cable unterminated, unconnected, loose or unsecured.

H. Color code distribution wiring to conform to ANSI/TIA 606-B and construction documents, whichever is more stringent. Label all equipment, conduit, enclosures, jacks, and cables on record drawings, to facilitate installation and maintenance.

I. In addition to requirements in Section 27 05 11, REQUIREMENTS FOR COMMUNICATION INSTALLATIONS, provide stainless steel faceplates with plastic covers over labels.

2.2 EQUIPMENT AND MATERIALS

A. Cable Systems - Twisted Pair, Fiber optic, Coaxial and Analog:

1. General:

a. Provide cable (i.e. backbone, outside plant, and horizontal cabling) conforming to accepted industry standards with regards to size, color code, and insulation.

b. Some areas can be considered “plenum”. Comply with all codes pertaining to plenum environments. It is contractor’s responsibility to review the VA’s cable requirements with COR and OI&T Service prior to installation to confirm type of environment present at each location.

c. Provide proper test equipment to confirm that cable pairs meet each OEM’s standard transmission requirements, and ensure cable carries data transmissions at required speeds, frequencies, and fully loaded bandwidth.

2. Telecommunications Rooms (TR):

a. In TR’s served with UTP fiber optic, coaxial and analog backbone cables, terminate UTP cable on RJ-45, 8-pin connectors of separate 48-port modular patch panels,/110A or equivalent type punch down blocks that are dedicated to voice and data applications.

b. Provide 24 port fiber optic modular patch panels with “LC” or OEM specified couplers dedicated for voice, data and FMS applications.

c. Provide connecting cables required to extend backbone cables (i.e. patch cords, twenty-five pair,), to ensure complete and operational distribution systems.

d. In TR’s, which are only served by a UTP backbone cable, terminate cable on separate modular connecting devices, Type 110A punch down blocks (or equivalent), dedicated to data applications.

3. Backbone Copper Cables:

a. Riser Cable:

1) Provide communication riser cables listed in NEC Table 800, 154(a) for the purpose and suited for electrical connection to a communication network.

2) Provide STP or Unshielded Twisted Pair (UTP), minimum 24 American Wire Gauge (AWG) solid, thermoplastic insulated conductors for communication (analog RF coaxial cable is not to be provided in riser systems) riser cables with a thermoplastic outer jacket.

3) Label and test complete riser cabling system.

4. Horizontal Cable: Installed from TCO jack to the TR patch panel.

a. Tested to ANSI/TIA-568-C.2 Category 6A requirements including NEXT, ELFEXT (Pair-to-Pair and Power Sum), Insertion Loss (attenuation), Return Loss, and Delay Skew.

b. Minimum Transmission Parameters: 250 MHz .

c. Provide four pair 0.205 mm2 (24 AWG) cable

d. Terminate all four pairs on same port at patch panel in TR.

e. Terminate all four pairs on same jack, at work area Telecommunication Outlets (TCO):

1) Jacks: Minimum three eight-pin RJ-45 ANSI/TIA-568-C.2 Category 6A Type jacks at TCO.

a) Top Port: RJ-45 jack compatible with RJ-11 plug for voice.

b) Bottom Two Ports: Unkeyed RJ-45 jacks for data.

5. Patient Bedside Prefabricated Units (PBPU):

a. Where PBPU’s exist in facility, identify single gang "box" location on PBPU designated for installation of TCO; obtain written approval and specific instructions from PBPU OEM regarding disassembly and reassembly of each PBPU to extent necessary to install cable to PBPU box reserved for TCO.

b. Provide stainless steel face plate approved for use by PBPU OEM and COR.

6. Fiber Optics Backbone Cable:

a. Provide 50/125 (for Bell System Interconnection Compatibility micron OM4 multi-mode cable, containing at minimum 18 strands of fiber, unless otherwise specified.

b. Provide loose tube cable, which separates individual fibers from the environment, or indoor/outdoor cables, for outdoor runs or any area that includes an outdoor run.

c. Provide tight buffered fiber cable or indoor/outdoor cables for indoor runs.

d. Terminate multimode fibers at both ends with LC type female connectors installed in an appropriate patch or breakout panel and secured with a cable management system. Provide minimum 610 mm (2 ft.) cable loop at each end.

e. Provide single mode fiber optic cable 8.3 mm containing at minimum 12 strands of fiber, unless otherwise specified. Terminate single mode fibers at both ends with LC type female connectors installed in an appropriate patch or breakout panel and secured with a cable management system. Provide minimum 610 mm (2 feet) cable loop at each end to allow for future movement.

f. Install fiber optic cables in TR's, Voice (Telephone) Switch Room, and Main Computer Room, in rack mounted fiber optic patch panels. Provide female LC couplers in appropriate panel for termination of each strand.

g. Test all fiber optic strands' cable transmission performance in accordance with TIA standards. Measure attenuation in accordance with fiber optic test procedures TIA-455-C ('-61', or -53). Provide written results to COR for review and approval.

B. Cross-Connect Systems (CCS):

1. Copper Cables: Provide copper CCS sized to connect cables at TR and allow for a minimum of 50 percent anticipated growth.

2. Maximum DC Resistance per Cable Pair: 28.6 Ohms per 305 m (1,000 feet).

3. Fiber Optic Cables:

a. Provide fiber CCS sized to connect cables at TR and allow for a minimum of 50 percent anticipated growth.

b. Install fiber optic cable slack in protective enclosures.

C. Telecommunication Room (TR):

1. Terminate backbone and horizontal, copper, fiber optic, coaxial and analog cables on appropriate cross-connection systems (CCS) containing patch panels, punch blocks, and breakout devices provided in enclosures and tested, regardless of installation method, mounting, termination, or cross-connecting used. Provide cable management system as a part of each CCS.

2. Coordinate location in TR with FMS equipment (i.e. fire alarm, nurse call, code blue, video, public address, radio entertainment, intercom, and radio paging equipment).

D. Coaxial and Analog Cables: Bond equipment to ground per TIA standards, such that all grounding systems comply with all applicable National, Regional, and Local Building and Electrical codes.

1. Provide current arrester for each copper or coaxial cable that enters from outside of a building regardless if cable is installed underground or aerial.

2. Provide a gas surge protector/module and bond to earth ground.

E. Main Cross-connection Subsystem (MCCS): MCCS is common point of distribution for inter- and intra-building copper and fiber optic backbone system cables, and connections to the voice (telephone) and data cable systems.

F. Voice (or Telephone) Cable Cross-Connection Subsystem:

1. Provide Insulation Displacement Connection (IDC) hardware.

2. Provide the following for each Category 6A for specialized powered systems technically accepted by SMCS 005OP2H3, (202) 461-5310, OI&T and FMS Services and COR) Cabling System termination; cross-connection wires, RJ-45 patch cord connector to RJ-45 patch cord connector , hybrid modular cord to IDC patch cord connector.

a. Provide terminations to be accessible without need for disassembly of IDC wafer. Provide IDC wafers removable from their mounts to facilitate testing on either side of connector.

b. Provide removable designation strips or labels to allow for inspection of terminations.

c. Provide cable management system as a part of IDC.

3. Provide IDC connectors capable of re-terminations, without damage, a minimum of 200 IDC insertions or withdrawals on either side of connector panel.

4. Install using only non-impact terminating tool having both a tactile and an audible feedback to indicate proper termination.

5. Provide inputs from , FTS, Local Voice (Telephone) System, or diverse routed voice distribution systems on left side of IDC (110A blocks with RJ45 connections are acceptable alternates to IDC) of MCCS.

6. Provide system outputs from MCCS to voice backbone cable distribution system on the right side of same IDC (or 110A blocks) of MCCS.

7. Do not split pairs within cables between different jacks or connections.

8. Provide UTP cross connect wire to connect each pair of terminals plus an additional 50 percent spare.

G. Data Cross-Connection Subsystems:

1. Provide patch panels with modular RJ45 female to 110 connectors for cross-connection of copper data cable terminations and system ground with cable management system.

2. Provide patch panels conforming to EIA/ECA 310-E dimensions and suitable for mounting in standard equipment racks, with 48 RJ45 jacks aligned in two horizontal rows per panel. Provide RJ45 jacks of modular design and capable of accepting and functioning with other modular (i.e. RJ11) plugs without damaging jack.

a. Provide system inputs from servers, data LAN, bridge, or interface distribution systems on top row of jacks of appropriate patch panel.

b. Provide backbone cable connections on bottom row of jacks of same patch panel.

c. Provide patch cords for each system pair of connection jacks with modular RJ45 connectors provided on each end to match panel's modular RJ45 female jack's being provided.

H. Fiber-Optic Cross-Connection Subsystems: Provide rack mounted patch or distribution panels installed inside a lockable cabinet or "breakout enclosure" that accommodate minimum 12 strands multimode fiber and 12 strand single mode fiber - these counts do not include 50 percent spare requirement. Provide cable management system for each panel.

1. Provide panels for minimum 24 female LC connectors, able to accommodate splices and field mountable connectors and have capacity for additional connectors to be added up to OEM's maximum standard panel size for this type of use. Protect patch panel sides, including front and back, by a cabinet or enclosure.

2. Provide panels that conform to EIA/ECA 310-E dimensions suitable for installation in standard racks, cabinets, and enclosures. Provide panels for system grounding where armored cables are installed.
3. Provide patch panels with highest OEM approved density of fiber LC termination's (maximum of 72 each), while maintaining a high level of manageability. Provide proper LC couplers installed for each pair of fiber optic cable LC connectors.
   a. Provide system inputs from interface equipment or distribution systems on top row of connectors of appropriate patch panel.
   b. Provide backbone cable connections on bottom row of connectors of same patch panel.
   c. Provide patch cords for each pair of fiber optic strands with connector to match couplers.
4. Provide field installable connectors that are pre-polished.
   a. Terminate every fiber cable with appropriate connector, and test to ensure compliance to specifications and industry standards for fiber optic LC female connector terminated with a fiber optic cable.
   b. Install a terminating cap for each unused LC connector.

I. Copper Outside Plant Cable: Minimum of STP or UTP, 22 AWG solid conductors, solid PVC insulation, and filled core (flex gel - waterproof Rural Electric Association (REA) listed PE 39 code) between outer armor or jacket and inner conductors protective lining.
   1. Provide copper cable system as a Star Topology.

J. Horizontal Cabling (HC):
   1. Horizontal cable length to farthest system outlet to be maximum of 90 m (295 ft).
   2. Splitting of pairs within a cable between different jacks is not permitted.

K. Air Blown Fiber: Alternative fiber optic cable installation method.
   1. Air blown fiber installation process (also referred to as air blown cable, air assisted cable, high pressure air blowing, cable jetting, and referred to as air blown fiber herein) typically uses separate optical fiber cables along with separate flexible protective microducts installed where optical fiber cables can be blown in using specific equipment, trained installation personnel and practices.
   2. Indoor Microducts:
      a. Provide empty bundled microducts comprising an inner layer of microducts optimized for air blown fiber system and an outer jacket layer of plenum riser general purpose rated material with product identification and sequential length marking on outer layer at minimum one-meter (three feet) intervals.
      b. Provide microduct allowing multiple fibers to be installed simultaneously into each microduct using air blown fiber installation technique and fibers to also be removed from microduct using same technique.

c. Size each microduct for 50 percent unoccupied microducts after initial fiber bundle installation.

d. Furnish microducts that maintain minimum bend radius of 20 times cable diameter.

e. Provide quantity of plugs or end-caps so all unoccupied microducts are plugged on both ends per manufacturer's specifications. Provide plugs or end-caps that can be easily installed or removed from duct connectors as needed over the lifetime of the installation.

3. Outside Microducts:

a. Provide outdoor-rated bundled microducts consisting of a number of empty microducts comprising an inner layer of microducts optimized for air blown fiber system and covered by a rated jacketing material with product identification and sequential length marking on outer layer at one-meter (three feet) minimum intervals.

b. Provide microducts with rodent protection at direct buried applications.

c. .

d. Water-blocking must be accomplished by utilizing a moisture barrier within the bundled microduct assembly or by utilizing water-blocked fiber cable.

e. Provide microduct allowing multiple fibers to be installed simultaneously into each microduct using air blown fiber installation technique and fibers to also be removed from microduct using same technique.

f. For future capacity, size each microduct provided for 50 percent unoccupied microducts after initial fiber bundle installation.

g. Furnish microducts to maintain minimum bend radius twenty times cable diameter.

h. Provide quantity of plugs or end-caps so unoccupied microducts are plugged on both ends per manufacturer's specifications, to prevent ingress of contaminants including water.

4. Microduct Couplers: Provide plastic-bodied pneumatic connector to join microducts of same size.

a. Provide straight connectors constructed of a transparent plastic material permitting a visual verification of fiber population.

b. Provide tee connectors with additional port allowing for gas-blocking in internal/external situations, or provide gas-blocking couplers as needed to protect and isolate classified areas from non-classified areas or provide close-down connectors if needed for midspan assisted blows in long runs

5. Microduct Distribution Units: Provide NEMA-rated enclosure, suited for site environmental conditions provided for microduct distribution, routing, and termination.

a. Provide unit capable of wall mounting to provide proper geometry for distribution wherever several microducts enter same location or where microduct type transitions take place.

b. Size based on number of microducts to enter unit.

6. Outdoor Enclosure/Splice Case: Provide outdoor NEMA-rated enclosure, or splice case suitable for site environmental conditions of outside plant microduct distribution and routing.
   a. Splice Cases: Water-tight, and air-tight re-enterable splice cases that do not require re-entry kits.
   b. Material: Stainless steel.
   c. Select enclosure/splice case hardware to meet site conditions.
      1) Provide NEMA-4 and 4X enclosures or splice cases in areas where hosing and splashing environmental conditions exist.
      2) Provide NEMA-6 and 6P enclosures splice cases in areas where temporary or long term flooded environmental conditions exist.
7. Fiber Termination Units: Provide at locations where fiber is to be terminated.
   a. Provide for strain relief of incoming microducts.
   b. Provide connector panels and connector couplings adequate to accommodate the number of fibers to be terminated.
   c. Incorporate radius control mechanisms to limit bending of fibers to manufacturer's recommended minimum or 76 mm (3 inches), whichever is larger.
   d. Where rack-mount fiber termination hardware is required, provide wall-mount microduct distribution unit near rack and provide individual microducts to route and connect fiber bundle passing through microduct distribution units to fiber termination hardware.
   e. Provide LC connectors mounted on a coupler panel that snaps into patch panel housing assembly.
8. Fiber Bundles or Cables:
   a. Provide fiber bundles or cables designed and manufactured to facilitate:
      1) Rapid installation of fiber using air blown fiber installation process without risk or damage to fibers.
      2) Re-installation without degradation of the optical specifications and performance of fiber.
      3) Transition points from indoor to outdoor environments without splices.
   b. Provide jacketed optical fibers manufactured so that the jacketed fiber strands meet GR409 and meet either UL 1666 for riser rated cables or UL 910 for plenum rated cables and are specific to the purpose of being blown throughout the bundled microduct system.
   c. Provide fiber designed to be stripped and terminated with standard tools.
   d. Provide fiber designed to be terminated with standard fiber optic connectors.
   e. Provide maximum 72 strands of fiber to be blown within each microduct; if fiber counts higher than 72 strands are required, provide microcore fiber with counts to 432 strands in larger size microducts.

2.3 DISTRIBUTION EQUIPMENT AND SYSTEMS

A. Telecommunication Outlet:

1. TCO consists of minimum one voice (telephone) RJ45 jack and two data RJ45 jacks mounted in a separate steel outlet box 100 mm (4 inches) x 100 mm (4 inches) x 63 mm (2-1/2 inches) minimum with a labeled stainless steel faceplate. Where shown on drawings, provide a second steel outlet box minimum 100 mm (4 inches) x 100 mm (4 inches) x 63 mm (2-1/2 inches), with a labeled faceplate, adjacent to first box to ensure system connections and expandability requirements are met.
2. Provide RJ-45/11 compatible female type voice (telephone) multi-pin connections. Provide RJ-45 female type data multi-pin connections. ferrule female type fiber optic connectors.
3. Provide wall outlet with a stainless steel face plate and sufficient ports to fit voice (telephone) multi-pin jack, data multi- pin jacks and plastic covers for labels when mounted on outlet box provided (minimum 100mm (4 inches) x 100mm (4 inches) for single and 100mm (4 inches) x 200mm (8 inches) for dual outlet box applications. Install stainless steel face plate, for prefabricated bedside patient unit installations.
4. Interface fiber optic LC jacks to appropriate patch panels in associated TR, but do not cross-connect fiber optic cables fiber optic equipment or install fiber optic equipment.

B. Backbone Distribution Cables:

1. Meet TIA transmission performance requirements of Voice Grade Category 6A.
2. Provide cable listed for environments where it is installed.
3. Technical Characteristics:
   a. Length: As required, in minimum 1 kilometer (3,000 ft.) reels.
   b. Size:
      1) Minimum 0.326 mm2 (22 AWG) outside plant installation.
      2) Minimum 0.205 mm2 (24 AWG) interior installations.
   c. Color Coding: American Telephone and Telegraph Company Standard; Bell System Practices Outside Plant Construction and Maintenance Section G50.607.3, Issue 2 February, 1959.
   d. Minimum Bend Radius: 10X cable outside diameter.
   e. Impedance: 120 Ohms + 15 percent.
   f. DC Resistance: Maximum 8.00 ohms/100 m
   g. Shield Coverage: As required by drawing notes single shield tape design flat shield bonded to cable jacket.
   h. Maximum attenuation for 100m at 20° C:

Frequency (MHz)				Category 6A (dB)
.772				-

Frequency (MHz)				Category 6A (dB)
1				2.1
4				3.8
8				5.3
10				5.9
16				7.5
20				8.4
25				9.4
31.25				10.5
62.5				15.0
100				19.1
200				27.6
250				31.1
300				34.3
400				40.1
500				45.3

4. Data Multi-Conductor:
   a. Unshielded F/UTP cable with solid conductors.
   b. Able to handle the power and voltage used over the distance required.
   c. Meets TIA transmission performance requirements of Category 6A.
   d. Technical Characteristics:
      1) 0.205 mm2 (24 AWG) - 0.326 mm2 (22 AWG) cable
      2) Working Shield: 350 V.
      3) Bend Radius: 10 times cable outside diameter.
      4) Impedance: 100 Ohms + 15%, BAL.
      5) Bandwidth: 250 MHz.
      6) DC Resistance: Maximum 9.38 Ohms/100m (328 ft.) at 20 degrees C.
      7) Maximum Mutual Capacitance: 5.6 nF per 100 m (328 ft.).
      8) Shield Coverage:
         a) Overall Outside (if OEM specified): 100 percent.

b) Individual Pairs (if OEM specified): 100 percent.

9) Maximum attenuation for 100m (328 ft.) at 20° C:

Frequency (MHz)			Category 6A (dB)
1			2.1
4			3.8
8			5.3
10			5.9
16			7.5
20			8.4
25			9.4
31.25			10.5
62.5			15.0
100			19.1
200			27.6
250			31.1
300			34.3
400			40.1
500			45.3

5. Fiber Optic:

a. Multimode Fiber:

1) Provide OM4 Type general purpose multimode fiber optic cable installed in conduit for system locations with load-bearing support braid surrounding inner tube for strength during cable installation.

2) Technical Characteristics:

a) Bend Radius: Minimum 152 mm (6 inches); outer jacket as required.

b) Fiber Diameter: 50 microns.

c) Cladding: 125 microns.

d) Attenuation:

1) 850 nanometer: Maximum 4.0 dB per kilometer.

2) 1,300 nanometer: Maximum 2.0 dB per kilometer.

e) Bandwidth:

1) 850 nanometer: Minimum 160 MHz.

2) 1,300 nanometer: Minimum 500 MHz.

f) Connectors: Stainless steel.

b. Single mode Fiber:

1) Provide OS1 Type general purpose single mode fiber optic cable installed in conduit for all system locations with load-bearing support braid surrounding inner tube for strength during cable installation.

2) Technical Characteristics:

a) Bend Radius: Minimum 100 mm (4 inches).

b) Outer Jacket: PVC.

c) Fiber Diameter: 8.7 microns.

d) Cladding: 125 microns.

e) Attenuation at 850 nanometer: 1.0 dBm per kilometer.

f) Connectors: Ceramic.

C. Outlet Connection Cables:

1. Voice (Telephone):

a. Provide a connection cable for each TCO voice (telephone) jack in system with 10 percent spares able to connect voice (telephone) connection cable from voice (telephone) instrument to TCO voice (telephone) jack. Do not provide voice (telephone) instruments or equipment.

b. Technical Characteristics:

1) Length: Minimum 1.8 m (6 feet).

2) Cable: Voice Grade.

3) Connector: RJ-11/45 compatible male on each end.

4) Size: Minimum 24 AWG.

5) Color Coding: Required, telephone industry standard.

2. Data:

a. Provide a connection cable for each TCO data jack in system with 10 percent spares to connect a data instrument to TCO data jack. Do not provide data terminals/equipment.

b. Technical Characteristics:

1) Length: Minimum 1.8 m (6 feet).

2) Cable: Data grade Category 6A for specialized powered systems accepted by SMCS 005OP2H3 (202) 461-5310, IT and FMS Services and COR.

3) Connector: RJ-45 male on each end.

4) Color Coding: Required, data industry standard.

5) Size: Minimum 24 AWG.

3. Fiber Optic:

a. Provide a connection cable for each TCO fiber optic connector in system with 10 percent spares. Provide data connection cable to connect a fiber optic instrument to TCO fiber optic jack. Do not provide fiber optic instruments/equipment.

b. Technical Characteristics:

1) Length: Minimum 1.8 m (6 feet).

2) Cable: Flexible single conductor with jacket.

3) Connector: LC male on each end.

4) Size: To fit OM1 single mode or OM4 multimode cable.

D. System Connectors:

1. Modular (RJ-45/11 and RJ-45): Provide voice and high speed data transmission applications type modular plugs compatible with voice (telephone) instruments, computer terminals, and other type devices requiring linking through modular telecommunications outlet to the system compatible with UTP F/UTP cables.

a. Technical Characteristics:

1) Number of Pins:

a) RJ-45: Eight.

b) RJ-11/45: Compatible with RJ-45.

2) Dielectric: Surge.

3) Voltage: Minimum 1,000V RMS, 60 Hz at one minute.

4) Current: 2.2A RMS at 30 minutes or 7.0A RMS at 5.0 seconds.

5) Leakage: Maximum 100 µA.

6) Connections:

a) Initial contact resistance: Maximum 20 milli-Ohms.

b) Insulation displacement: Maximum 10 milli-Ohms.

c) Interface: Must interface with modular jacks from a variety of OEMs. RJ-11/45 plugs provide connection when used in RJ-45 jacks.

d) Durability: Minimum 200 insertions/withdrawals.

E. Fiber Optic Terminators:

1. Pre-polished crimp on type that has proper ferrule to terminate fiber optic cable.

2. Technical Characteristics:

a. Frequency: Light wave.

b. Power Blocking: As required.

c. Return Loss: 25 dB.

d. Connectors: LC .

e. Construction: Ceramic.

F. Conduit and Signal Ducts:

1. Conduit:

a. Provide conduit or sleeves for cables penetrating walls, ceilings, floors, interstitial space, fire barriers,.

b. Minimum Conduit Size: 19 mm (3/4 inch).

c. Provide separate conduit and signal ducts for each cable type installation.

d. When metal (plastic covered, flexible cable protective armor,.) systems are authorized to be provided for use in system, follow installation guidelines and standard specified in Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS and NEC.

e. Maximum 40 percent conduit fill for cable installation.

2. Signal Duct, Cable Duct, or Cable Tray: Use existing signal duct, cable duct, and cable tray, when identified and accepted by COR.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install for ease of operation, maintenance, and testing.

B. Install system to comply with NFPA 70 National Electrical Code, NFPA 99 Health Care Facilities, NFPA 101 Life Safety Code, Joint Commission Manual for Health Care Facilities, and original equipment manufacturers' (OEM) installation instructions.

C. Cable Systems Installation:

1. Install system cables in cable duct, cable tray, cable runway, conduit or when specifically approved, flexible NEC Article 800 communications raceway. Confirm drawings show sufficient quantity and size of cable pathways. If flexible communications raceway is used, install in same manner as conduit.

2. Coordinate outside plant and backbone cables to furnish number of cable pairs for system requirements and obtain approval of COR and IT Service prior to installation.

3. Bond to ground metallic cable sheaths,. (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, must be reviewed and accepted by COR, IT Service, FMS and SMCS 005OP2H3 (202-461-5310) prior to installation.

D. Patient Bedside Prefabricated Units (PBPU) Installation:

1. Under no circumstances, proceed with installing PBPU without written approval of PBPU OEM and specific instructions regarding attachment to or modifying of PBPU.

2. Maintain UL integrity of each PBPU. If installation violates UL integrity, obtain on site UL re-certification of violated PBPU at the direction of COR.

E. Labeling:

1. Industry Standard: Provide labeling in accordance with ANSI/TIA-606-B.
2. Print lettering of labels with laser printers ; handwritten labels are not acceptable.
3. Label both ends of all cables in accordance with industry standard. Provide permanent Labels in contrasting colors and identify according to system “Record Wiring Diagrams”.
4. Termination Hardware: Label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with industry standard and record on“Record Wiring Diagrams”.

3.2 FIELD QUALITY CONTROL

A. Interim Inspection:
1. Verify that equipment provided adheres to installation requirements of this section. Interim inspection must be conducted by a factory-certified representative and witnessed by COR.
2. Check each item of installed equipment to ensure appropriate NRTL label.
3. Verify cabling terminations in telecommunications rooms and at workstations adhere to color code for T568B pin assignments and cabling connections comply with TIA standards.
4. Visually confirm marking of cables, faceplates, patch panel connectors and patch cords.
5. Perform fiber optical field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.
6. Notify COR of the estimated date the contractor expects to be ready for interim inspection, at least 20 working days before requested inspection date, so interim inspection does not affect systems’ completion date.
7. Provide results of interim inspection to COR. If major or multiple deficiencies are discovered, COR can require a second interim inspection before permitting contractor to continue with system installation.
8. Do not proceed with installation until COR determines if an additional inspection is required. In either case, re-inspection of deficiencies noted during interim inspections must be part of the proof of performance test.

B. Pretesting:
1. Pretest entire system upon completion of system installation.
2. Verify during system pretest, utilizing the accepted equipment, that system is fully operational and meets system performance requirements of this section.
3. Provide COR four copies of recorded system pretest measurements and the written certification that system is ready for formal acceptance test.

C. Microduct Tests:
1. Furnish COR, obstruction and pressure test data for each microduct installed. Complete pressure and obstruction tests per manufacturer’s recommended procedures prior to installing fiber, and ensure 100 percent of all microducts are compliant with manufacturer.

2. Complete microduct pressure testing before proceeding with end-to-end microduct obstruction testing.
3. Notify COR at least one week in advance of test date so that Government and design professional may be present to witness testing.
4. Maintain close contact with chosen and technically-approved OEM and SMCS 005OP2H3 throughout installation, testing and certification process.

D. Acceptance Test:
1. After system has been pretested and the contractor has submitted pretest results and certification to COR, then schedule an acceptance test date and give COR 30 days' written notice prior to date acceptance test is expected to begin.
2. Test only in presence of a COR.
3. Test utilizing approved test equipment to certify proof of performance.
4. Verify that total system meets the requirements of this section.
5. Include expected duration oftest time, with notification of the acceptance test.

E. Verification Tests:
1. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test cables after termination and prior to cross-connection.
2. Multi-mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with TIA-568-B.3 and TIA-526-14A using Method A, Optical Power Meter and Light Source and Method B, OTDR. Perform verification acceptance test.
3. Single mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with TIA-568-B.3 and TIA-526-7 using Method A, Optical Power Meter and Light Source and Method B, OTDR . Perform verification acceptance test.

F. Performance Testing:
1. Perform Category 6A for specialized powered systems accepted by SMCS 005OP2H3, (202) 461-5310, IT and FMS Services and COR) tests in accordance with TIA-568-B.1 and TIA-568-B.2. Include the following tests - wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.
2. Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with TIA-568-B.3.

G. Total System Acceptance Test: Perform verification tests for UTP copper cabling systems after complete telecommunication distribution system and workstation outlet are installed.

3.3 MAINTENANCE

A. Accomplish the following minimum requirements during one year warranty period:
1. Respond and correct on-site trouble calls, during standard work week:

a. A routine trouble call within one working day of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.

b. Standard work week is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal holidays.

2. Respond to an emergency trouble call within six hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at any time.

3. Respond on-site to a catastrophic trouble call within four hours of its report. A catastrophic trouble call is considered total system failure.

a. If a system failure cannot be corrected within four hours (exclusive of standard work time limits), provide alternate equipment, or cables within four hours after four hour trouble shooting time.

b. Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units.) are also be deemed as a catastrophic trouble.

4. Provide COR written report itemizing each deficiency found and the corrective action performed during each official reported trouble call. Provide COR with sample copies of reports for review and approval at beginning of total system acceptance test.

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SECTION 27 15 13
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for telecommunications copper (UTP) horizontal distribution cabling outside of the computer room. For copper (UTP) horizontal cabling in structured cabling systems in the computer room, see Section 27 13 13 Communications Copper Backbone Cabling.

1.2 SUMMARY

Section Includes:

A. Copper (UTP) Horizontal Cables.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Computer room structured cabling: Section 27 10 00, STRUCTURED CABLING.

B. Cable labeling requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS: NOT USED

PART 2 - PRODUCTS

2.1 COPPER (UTP) HORIZONTAL CABLES.

Copper (UTP) horizontal cables connect the Telecommunications Room (TR) to each end-user Work Area Outlet (WAO) (horizontal distribution).

A. Performance Category. Copper (UTP) horizontal cables shall meet the Category 6A performance requirements. Category 6A connectors are required.

B. Performance Specifications. Meets or exceeds TIA-EIA-568-C.2-10 and TSB-155.

C. Limited Power (LP) Certification. UL Listed as x-LP (0.5A).

D. Termination. Field terminated TIA 568B.

E. Testing. Following installation, each cable shall be field certified to meet performance category requirements per TIA 568-C.2.

F. Conductor Size. 22-24AWG.

G. Jacket Rating. Communications Multipurpose Cable, Plenum (CMP) shall be specified if any portion of the cable passes through an NEC-defined plenum. Communications Multipurpose Cable, Riser (CMR) shall be specified for all other applications. CMP may be used as a substitute for CMR.

H. Construction. Copper Clad Aluminum (CCA) cable is not permitted.

J. Length. The maximum distance for UTP horizontal cables is limited to 295 feet.

PART 3 - EXECUTION

3.1 IMPLEMENTATION.

A. 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:

This section specifies requirements for telecommunications patch cords.

1.2 SUMMARY

Section Includes:

A. Copper (UTP) Patch Cables.

B. Fiber Optic Patch Cables.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Cable labeling requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS: NOT USED

PART 2 - PRODUCTS

2.1 COPPER (UTP) PATCH CABLES.

A. Performance Category. Patch cables shall meet the Category 6A performance requirements. Category 6A connectors are required.

B. Termination Method. Factory pre-terminated TIA 568B.

C. Conductor Size. 22-28AWG. Where 28AWG patch cords are specified, the overall horizontal channel distance is reduced.

D. Length. Patch cords of the shortest appropriate length shall be used.

2.2 FIBER OPTIC PATCH CABLES.

A. Construction. Fiber patch cords shall be constructed of pairs (2-strands) of multimode laser-enhanced 50/125µm 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.

PART 3 - EXECUTION

3.1 IMPLEMENTATION.

A. Patch cords shall not be used to connect equipment in different server cabinets.

B. Patch cords shall be neatly installed using cable management equipment and following cable management principles.

C. Upon installation patch cords shall be labeled in accordance with the requirements of the VA Infrastructure Standard for Telecommunications Spaces.

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SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section of the specifications includes the furnishing, installation, and connection of the fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control units, fire safety control devices, annunciators, power supplies, and wiring as shown on the drawings and specified. The fire alarm system shall not be combined with other systems such as building automation, energy management, security, etc.

B. Fire alarm systems shall comply with requirements of the most recent VA FIRE PROTECTION DESIGN MANUAL and NFPA 72 unless variations to NFPA 72 are specifically identified within these contract documents by the following notation: "variation". The design, system layout, document submittal preparation, and supervision of installation and testing shall be provided by a technician that is certified NICET level III or a registered fire protection engineer. The NICET certified technician shall be on site for the supervision and testing of the system. Factory engineers from the equipment manufacturer, thoroughly familiar and knowledgeable with all equipment utilized, shall provide additional technical support at the site as required by the COR or his authorized representative. Installers shall have a minimum of 2 years experience installing fire alarm systems.

C. Fire alarm signals:

1. Building(s) B120 shall have a general evacuation fire alarm signal in accordance with ASA S3.41 to notify all occupants in the respective building to evacuate.

D. Alarm signals (by device), supervisory signals (by device) and system trouble signals (by device not reporting) shall be distinctly transmitted to the main fire alarm system control unit located in the first floor.

E. The main fire alarm control unit shall automatically transmit alarm signals to a listed central station using a digital alarm communicator transmitter in accordance with NFPA 72.

1.2 SCOPE

A. The fully addressable fire alarm system shall be maintained and extended in accordance with the specifications and drawings. Device location and wiring runs shown on the drawings are for reference only unless specifically dimensioned. Actual locations shall be in accordance with NFPA 72 and this specification.

B. All existing fire alarm equipment, wiring, devices and sub-systems that are not shown to be reused shall be removed. All existing fire alarm conduit not reused shall be removed.

C. Existing fire alarm bells, chimes, door holders, 120VAC duct smoke detectors, valve tamper switches and waterflow/pressure switches may be reused only as specifically indicated on the drawings and provided the equipment:
   1. Meets this specification section
   2. Is UL listed or FM approved
   3. Is compatible with new equipment being installed
   4. Is verified as operable through contractor testing and inspection
   5. Is warranted as new by the contractor.

D. Existing 120 VAC duct smoke detectors, waterflow/pressure switches, and valve tamper switches reused by the Contractor shall be equipped with an addressable interface device compatible with the new equipment being installed.

E. Existing reused equipment shall be covered as new equipment under the Warranty specified herein.

F. Basic Performance:
   1. Alarm and trouble signals from each building fire alarm control panel shall be digitally encoded by UL listed electronic devices onto a multiplexed communication system.
   2. Response time between alarm initiation (contact closure) and recording at the main fire alarm control unit (appearance on alphanumeric read out) shall not exceed 5 seconds.
   3. The signaling line circuits (SLC) between building fire alarm control units shall be wired Style 7 in accordance with NFPA 72. Isolation shall be provided so that no more than one building can be lost due to a short circuit fault.
   4. Initiating device circuits (IDC) shall be wired Style C in accordance with NFPA 72.
   5. Signaling line circuits (SLC) within buildings shall be wired Style 4 in accordance with NFPA 72. Individual signaling line circuits shall be limited to covering 22,500 square feet (2,090 square meters) of floor space or 3 floors whichever is less.
   6. Notification appliance circuits (NAC) shall be wired Style Y in accordance with NFPA 72.

1.3 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Requirements for procedures for submittals.

B. Section 07 84 00 - FIRESTOPPING. Requirements for fire proofing wall penetrations.

C. Section 21 13 16 - DRY-PIPE SPRINKLER SYSTEMS. Requirements for sprinkler systems.

D. Section 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Requirements for grounding of equipment.

E. Section 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.

1.4 SUBMITTALS

A. General: Submit 5 copies in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Drawings:

1. Prepare drawings using AutoCAD Release 14 software and include all contractors information. Layering shall be by VA criteria as provided by the Contracting Officer's Technical Representative (COR). Bid drawing files on AutoCAD will be provided to the Contractor at the pre-construction meeting. The contractor shall be responsible for verifying all critical dimensions shown on the drawings provided by VA.
2. Floor plans: Provide locations of all devices (with device number at each addressable device corresponding to control unit programming), appliances, panels, equipment, junction/terminal cabinets/boxes, risers, electrical power connections, individual circuits and raceway routing, system zoning; number, size, and type of raceways and conductors in each raceway; conduit fill calculations with cross section area percent fill for each type and size of conductor and raceway. Only those devices connected and incorporated into the final system shall be on these floor plans. Do not show any removed devices on the floor plans. Show all interfaces for all fire safety functions.
3. Riser diagrams: Provide, for the entire system, the number, size and type of riser raceways and conductors in each riser raceway and number of each type device per floor and zone. Show door holder interface, elevator control interface, HVAC shutdown interface, fire extinguishing system interface, and all other fire safety interfaces. Show wiring Styles on the riser diagram for all circuits. Provide diagrams both on a per building and campus wide basis.
4. Detailed wiring diagrams: Provide for control panels, modules, power supplies, electrical power connections, auxiliary relays and annunciators showing termination identifications, size and type conductors, circuit boards, LED lamps, indicators, adjustable controls, switches, ribbon connectors, wiring harnesses, terminal strips and connectors, spare zones/circuits. Diagrams shall be drawn to a scale sufficient to show spatial relationships between components, enclosures and equipment configuration.
5. Two weeks prior to final inspection, the Contractor shall deliver to the COR 3 sets of as-built drawings and one set of the as-built drawing computer files (using AutoCAD 2007 or later). As-built drawings (floor plans) shall show all new and/or existing conduit used for the fire alarm system.

C. Manuals:

1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets for all items used in the system, power

requirements, device wiring diagrams, dimensions, and information for ordering replacement parts.

a. Wiring diagrams shall have their terminals identified to facilitate installation, operation, expansion and maintenance.
b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
c. Include complete listing of all software used and installation and operation instructions including the input/output matrix chart.
d. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate, inspect, test and maintain the equipment and system. Provide all manufacturer's installation limitations including but not limited to circuit length limitations.
e. Complete listing of all digitized voice messages.
f. Provide standby battery calculations under normal operating and alarm modes. Battery calculations shall include the magnets for holding the doors open for one minute.
g. Include information indicating who will provide emergency service and perform post contract maintenance.
h. Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.
i. A computerized preventive maintenance schedule for all equipment. The schedule shall be provided on disk in a computer format acceptable to the VAMC and shall describe the protocol for preventive maintenance of all equipment. The schedule shall include the required times for systematic examination, adjustment and cleaning of all equipment. A print out of the schedule shall also be provided in the manual. Provide the disk in a pocket within the manual.
j. Furnish manuals in 3 ring loose-leaf binder or manufacturer's standard binder.
k. A print out for all devices proposed on each signaling line circuit with spare capacity indicated.

2. Two weeks prior to final inspection, deliver 4 copies of the final updated maintenance and operating manual to the COR.
   a. The manual shall be updated to include any information necessitated by the maintenance and operating manual approval.
   b. Complete "As installed" wiring and schematic diagrams shall be included that shows all items of equipment and their interconnecting wiring. Show all final terminal identifications.
   c. Complete listing of all programming information, including all control events per device including an updated input/output matrix.

d. Certificate of Installation as required by NFPA 72 for each building. The certificate shall identify any variations from the National Fire Alarm Code.

e. Certificate from equipment manufacturer assuring compliance with all manufacturers installation requirements and satisfactory system operation.

D. Certifications:

1. Together with the shop drawing submittal, submit the technician's NICET level III fire alarm certification as well as certification from the control unit manufacturer that the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include in the certification the names and addresses of the proposed supervisor of installation and the proposed performer of contract maintenance. Also include the name and title of the manufacturer's representative who makes the certification.

2. Together with the shop drawing submittal, submit a certification from either the control unit manufacturer or the manufacturer of each component (e.g., smoke detector) that the components being furnished are compatible with the control unit.

3. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer that the wiring and connection diagrams meet this specification, UL and NFPA 72 requirements.

1.5 WARRANTY

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer.

1.6 GUARANTY PERIOD SERVICES

A. Complete inspection, testing, maintenance and repair service for the fire alarm system shall be provided by a factory trained authorized representative of the manufacturer of the major equipment for a period of 1 year from the date of acceptance of the entire installation by the Contracting Officer.

B. Contractor shall provide all necessary test equipment, parts and labor to perform required inspection, testing, maintenance and repair.

C. All inspection, testing, maintenance and permanent records required by NFPA 72, and recommended by the equipment manufacturer shall be provided by the contractor. Work shall include operation of sprinkler system alarm and supervisory devices as well as all reused existing equipment connected to the fire alarm system. It shall include all interfaced equipment including but not limited to elevators, HVAC shutdown, and extinguishing systems.

D. Maintenance and testing shall be performed in accordance with NFPA 72. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment and cleaning of all equipment.

E. Non-included Work: Repair service shall not include the performance of any work due to improper use, accidents, or negligence for which the contractor is not responsible.

F. Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of the work performed and parts replaced shall be provided to the VA COR or his authorized representative.

G. Emergency Service:

1. Warranty Period Service: Service other than the preventative maintenance, inspection, and testing required by NFPA 72 shall be considered emergency call-back service and covered under the warranty of the installation during the first year of the warranty period, unless the required service is a result of abuse or misuse by the Government. Written notification shall not be required for emergency warranty period service and the contractor shall respond as outlined in the following sections on Normal and Overtime Emergency Call-Back Service. Warranty period service can be required during normal or overtime emergency call-back service time periods at the discretion of the COR or his authorized representative.
2. Normal and overtime emergency call-back service shall consist of an on-site response within 2 hours of notification of a system trouble.
3. Normal emergency call-back service times are between the hours of 7:30 a.m. and 4:00 p.m., Monday through Friday, exclusive of federal holidays. Service performed during all other times shall be considered to be overtime emergency call-back service.
4. Overtime emergency call-back service shall be provided for the system when requested by the Government. Payment for overtime emergency call-back service in excess of the 40 man hours per year requirement will be handled through separate purchase orders. The method of calculating overtime emergency call-back hours is based on actual time spent on site and does not include travel time.

H. The contractor shall maintain a log at each fire alarm control unit. The log shall list the date and time of all examinations and trouble calls, condition of the system, and name of the technician. Each trouble call shall be fully described, including the nature of the trouble, necessary correction performed, and parts replaced.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only and the latest editions of these publications shall be applicable.

B. National Fire Protection Association (NFPA):

NFPA 13 .....Standard for the Installation of Sprinkler Systems, 2010 edition

NFPA 14 ..... Standard for the Installation of Standpipes and Hose Systems, 2010 edition

NFPA 20 ..... Standard for the Installation of Stationary Pumps for Fire Protection, 2010 edition

NFPA 70..... National Electrical Code (NEC), 2023 edition

NFPA 72..... National Fire Alarm Code, 2010 edition

NFPA 90A..... Standard for the Installation of Air Conditioning and Ventilating Systems, 2009 edition

NFPA 101 ..... Life Safety Code, 2009 edition

C. Underwriters Laboratories, Inc. (UL): Fire Protection Equipment Directory

D. Factory Mutual Research Corp (FM): Approval Guide, 2007-2011

E. American National Standards Institute (ANSI):

S3.41 ..... Audible Emergency Evacuation Signal, 1990 edition, reaffirmed 2008

F. International Code Council, International Building Code (IBC), 2009 edition

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS, GENERAL

A. All equipment and components shall be new (unless noted otherwise) and the manufacturer's current model. All equipment shall be tested and listed by Underwriters Laboratories, Inc. or Factory Mutual Research Corporation for use as part of a fire alarm system. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturers' requirements and that satisfactory total system operation has been achieved.

2.2 CONDUIT, BOXES, AND WIRE

A. Conduit shall be in accordance with Section 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS and as follows:

1. All new conduits shall be installed in accordance with NFPA 70.
2. Conduit fill shall not exceed 40 percent of interior cross sectional area.
3. All new conduits shall be 3/4 inch (19 mm) minimum.

B. Wire:

1. Wiring shall be in accordance with NEC article 760, and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.
2. Addressable circuits and wiring used for the multiplex communication loop shall be twisted and shielded unless specifically excepted by the fire alarm equipment manufacturer in writing.
3. Any fire alarm system wiring that extends outside of a building shall have additional power surge protection to protect equipment from physical damage and false signals due to lightning, voltage and current induced transients. Protection devices shall be shown on the

submittal drawings and shall be UL listed or in accordance with written manufacturer's requirements.

4. All wire or cable used in underground conduits including those in concrete shall be listed for wet locations.

C. Terminal Boxes, Junction Boxes, and Cabinets:

1. Shall be galvanized steel in accordance with UL requirements.
2. All boxes shall be sized and installed in accordance with NFPA 70.
3. covers shall be repainted red in accordance with Section 09 91 00, PAINTING and shall be identified with white markings as "FA" for junction boxes and as "FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of 3/4 inch (19 mm) high.
4. Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.
5. Terminal boxes and cabinets shall have identified pressure type terminal strips and shall be located at the base of each riser. Terminal strips shall be labeled as specified or as approved by the COR.

2.3 FIRE ALARM CONTROL UNIT

A. General:

1. Existing EST panel (relocated). Provide new EST enclosure.

B. Enclosure:

1. The control unit shall be housed in a cabinet suitable for both recessed and surface mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. Cabinet shall contain all necessary relays, terminals, lamps, and legend plates to provide control for the system.

D. Power Supply:
   1. The control unit shall derive its normal power from a 120 volt, 60 Hz dedicated supply connected to the emergency power system. Standby power shall be provided by a 24 volt DC battery as hereinafter specified. The normal power shall be transformed, rectified, coordinated, and interfaced with the standby battery and charger.
   2. The door holder power shall be arranged so that momentary or sustained loss of main operating power shall not cause the release of any door.
   3. Power supply for smoke detectors shall be taken from the fire alarm control unit.
   4. Provide protectors to protect the fire alarm equipment from damage due to lightning or voltage and current transients.
   5. Provide new separate and direct ground lines to the outside to protect the equipment from unwanted grounds.

E. Circuit Supervision: Each alarm initiating device circuit, signaling line circuit, and notification appliance circuit, shall be supervised against the occurrence of a break or ground fault condition in the field wiring. These conditions shall cause a trouble signal to sound in the control unit until manually silenced by an off switch.

F. Supervisory Devices: All sprinkler system valves, standpipe control valves, post indicator valves (PIV), and main gate valves shall be supervised for off-normal position. Closing a valve shall sound a supervisory signal at the control unit until silenced by an off switch. The specific location of all closed valves shall be identified at the control unit. Valve operation shall not cause an alarm signal. Low air pressure switches and duct detectors shall be monitored as supervisory signals. The power supply to the elevator shunt trip breaker shall be monitored by the fire alarm system as a supervisory signal.

G. Trouble signals:
   1. Arrange the trouble signals for automatic reset (non-latching).
   2. System trouble switch off and on lamps shall be visible through the control unit door.

H. Function Switches: Provide the following switches in addition to any other switches required for the system:
   1. Remote Alarm Transmission By-pass Switch: Shall prevent transmission of all signals to the main fire alarm control unit when in the "off" position. A system trouble signal shall be energized when switch is in the off position.
   2. Alarm Off Switch: Shall disconnect power to alarm notification circuits on the local building alarm system. A system trouble signal shall be activated when switch is in the off position.
   3. Trouble Silence Switch: Shall silence the trouble signal whenever the trouble silence switch is operated. This switch shall not reset the trouble signal.

4. Reset Switch: Shall reset the system after an alarm, provided the initiating device has been reset. The system shall lock in alarm until reset.
5. Lamp Test Switch: A test switch or other approved convenient means shall be provided to test the indicator lamps.
6. Drill Switch: Shall activate all notification devices without tripping the remote alarm transmitter. This switch is required only for general evacuation systems specified herein.
7. Door Holder By-Pass Switch: Shall prevent doors from releasing during fire alarm tests. A system trouble alarm shall be energized when switch is in the abnormal position.
8. Elevator recall By-Pass Switch: Shall prevent the elevators from recalling upon operation of any of the devices installed to perform that function. A system trouble alarm shall be energized when the switch is in the abnormal position.
9. HVAC/Smoke Damper By-Pass: Provide a means to disable HVAC fans from shutting down and/or smoke dampers from closing upon operation of an initiating device designed to interconnect with these devices.

I. Remote Transmissions:
1. Provide capability and equipment for transmission of alarm, supervisory and trouble signals to the main fire alarm control unit.
2. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

J. Remote Control Capability: Each building fire alarm control unit shall be installed and programmed so that each must be reset locally after an alarm, before the main fire alarm control unit can be reset. After the local building fire alarm control unit has been reset, then the all system acknowledge, reset, silence or disabling functions can be operated by the main fire alarm control unit

K. System Expansion: Design the control units and enclosures so that the system can be expanded in the future (to include the addition of 20 percent more alarm initiating, alarm notification and door holder circuits) without disruption or replacement of the existing control unit and secondary power supply.

2.4 ANNUNCIATION

A. Annunciator, Alphanumeric Type (System):
1. Shall be a supervised, LCD display containing a minimum of 2 lines of 40 characters for alarm annunciation in clear English text.
2. Message shall identify building number, floor, zone, etc on the first line and device description and status (pull station, smoke detector, waterflow alarm or trouble condition) on the second line.
3. The initial alarm received shall be indicated as such.
4. A selector switch shall be provided for viewing subsequent alarm messages.

5. The display shall be UL listed for fire alarm application.
6. Annunciators shall display information for all buildings connected to the system. Local building annunciators, for general evacuation system buildings, shall be permitted when shown on the drawings and approved by the COR.

2.5 ALARM NOTIFICATION APPLIANCES

A. Bells:
1. Shall be electric, single-stroke or vibrating, heavy-duty, under-dome, solenoid type.
2. Unless otherwise shown on the drawings, shall be 6 inches (150 mm) diameter and have a minimum nominal rating of 80 dBA at 10 feet (3,000 mm).
3. Mount on removable adapter plates on outlet boxes.
4. Bells located outdoors shall be weatherproof type with metal housing and protective grille.
5. Each bell circuit shall have a minimum of 20 percent spare capacity.

B. Speakers:
1. Shall operate on either 25 VRMS or 70.7 VRMS with field selectable output taps from 0.5 to 2.0W and originally installed at the 1/2 watt tap. Speakers shall provide a minimum sound output of 80 dBA at 10 feet (3,000 mm) with the 1/2 watt tap.
2. Frequency response shall be a minimum of 400 HZ to 4,000 HZ.
3. Four inches (100 mm) or 8 inches (200 mm) cone type speakers ceiling mounted with white colored baffles in areas with suspended ceilings and wall mounted in areas without ceilings.

C. Strobes:
1. Xenon flash tube type minimum 15 candela in toilet rooms and 75 candela in all other areas with a flash rate of 1 HZ. Strobes shall be synchronized where required by the National Fire Alarm Code (NFPA 72).
2. Backplate shall be red with 1/2 inch (13 mm) permanent red letters. Lettering to read "Fire", be oriented on the wall or ceiling properly, and be visible from all viewing directions.
3. Each strobe circuit shall have a minimum of 20 percent spare capacity.
4. Strobes may be combined with the audible notification appliances specified herein.

D. Fire Alarm Horns:
1. Shall be electric, utilizing solid state electronic technology operating on a nominal 24 VDC.
2. Shall be a minimum nominal rating of 80 dBA at 10 feet (3,000 mm).
3. Mount on removable adapter plates on conduit boxes.
4. Horns located outdoors shall be of weatherproof type with metal housing and protective grille.
5. Each horn circuit shall have a minimum of 20 percent spare capacity.

2.6 ALARM INITIATING DEVICES

A. Manual Fire Alarm Stations:
1. Shall be non-breakglass, address reporting type.

2. Station front shall be constructed of a durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.
3. Stations shall be of single action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE."
4. Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until reset. A key shall be required to gain front access for resetting, or conducting tests and drills.
5. Unless otherwise specified, all exposed parts shall be red in color and have a smooth, hard, durable finish.

B. Smoke Detectors:
1. Smoke detectors shall be photoelectric type and UL listed for use with the fire alarm control unit being furnished.
2. Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.
3. Detectors shall have an indication lamp to denote an alarm condition. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
4. All spot type and duct type detectors installed shall be of the photoelectric type.
5. Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot.
6. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.

C. Heat Detectors:
1. Heat detectors shall be of the addressable restorable rate compensated fixed-temperature spot type.
2. Detectors shall have a minimum smooth ceiling rating of 2,500 square feet (230 square meters).
3. Ordinary temperature (135 degrees F (57 degrees C)) heat detectors shall be utilized in elevator shafts and elevator mechanical rooms. Intermediate temperature rated (200 degrees F (93 degrees C)) heat detectors shall be utilized in all other areas.

4. Provide a remote indicator lamp, key test station and identification nameplate (e.g. “Heat Detector - Elevator P-_____) for each elevator group. Locate key test station in plain view on elevator machine room wall.

D. Water Flow and Pressure Switches:

1. Wet pipe water flow switches and dry pipe alarm pressure switches for sprinkler systems shall be connected to the fire alarm system by way of an address reporting interface device.
2. All new water flow switches shall be of a single manufacturer and series and non-accumulative retard type. See Section 21 13 16, DRY-PIPE SPRINKLER SYSTEMS for new switches added. Connect all switches shown on the approved shop drawings.
3. All new switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Timing shall be recorded and documented during testing.

E. Extinguishing System Connections:

1. Kitchen Range Hood and Duct Suppression Systems:
   a. Each suppression system shall be equipped with a micro-switch connected to the building fire alarm control unit. Discharge of a suppression system shall automatically send a alarm signal to the building fire detection and alarm system for annunciation.
   b. Operation of this suppression system shall also automatically shut off all sources of fuel and heat to all equipment requiring protection under the same hood.
2. Each gaseous suppression system shall be monitored for system alarm and system trouble conditions via addressable interface devices.

2.7 SUPERVISORY DEVICES

A. Duct Smoke Detectors:

1. Duct smoke detectors shall be provided and connected by way of an address reporting interface device. Detectors shall be provided with an approved duct housing mounted exterior to the duct, and shall have perforated sampling tubes extending across the full width of the duct (wall to wall). Detector placement shall be such that there is uniform airflow in the cross section of the duct.
2. Interlocking with fans shall be provided in accordance with NFPA 90A and as specified hereinafter under Part 3.2, "TYPICAL OPERATION".
3. Provide remote indicator lamps, key test stations and identification nameplates (e.g. "DUCT SMOKE DETECTOR AHU-X") for all duct detectors. Locate key test stations in plain view on walls or ceilings so that they can be observed and operated from a normal standing position.

B. Sprinkler and Standpipe System Supervisory Switches:

1. Each sprinkler system water supply control valve, riser valve or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.

2. PIV (post indicator valve) or main gate valve shall be equipped with a supervisory switch.
3. Valve supervisory switches shall be connected to the fire alarm system by way of address reporting interface device. See Section 21 13 16, DRY-PIPE SPRINKLER SYSTEMS for new switches to be added. Connect tamper switches for all control valves shown on the approved shop drawings.
4. The mechanism shall be contained in a weatherproof die-cast aluminum housing that shall provide a 3/4 inch (19 mm) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The entire installed assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.
6. Where dry-pipe sprinkler systems are installed, high and low air pressure switches shall be provided and monitored by way of an address reporting interface devices.

2.8 ADDRESS REPORTING INTERFACE DEVICE

A. Shall have unique addresses that reports directly to the building fire alarm panel.
B. Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.
C. Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.
D. Shall be UL listed for fire alarm use and compatibility with the panel to which they are connected.
E. Shall be mounted in weatherproof housings if mounted exterior to a building.

2.9 UTILITY LOCKS AND KEYS:

A. All key operated test switches, control units, annunciator panels and lockable cabinets shall be provided with a single standardized utility lock and key.
B. Key-operated manual fire alarm stations shall have a single standardized lock and key separate from the control equipment.
C. All keys shall be delivered to the COR.

2.13 SPARE AND REPLACEMENT PARTS

A. Provide spare and replacement parts as follows:
   1. Manual pull stations - 1
   2. Heat detectors - 1 of each type
   3. Fire alarm strobes - 2
   4. Fire alarm speakers - 2
   5. Smoke detectors - 4
   6. Duct smoke detectors with all appurtenances - 1
   7. Sprinkler system water flow switch - 1 of each size
   8. Sprinkler system water pressure switch - 1 of each type
   9. Sprinkler valve tamper switch - 1 of each type

10. Control equipment utility locksets - 1
11. Control equipment keys - 2
12. 2.5 oz containers aerosol smoke - 2
13. Monitor modules - 2
14. Control modules - 2
15. Fire alarm SLC cable (same as installed) – 200 feet (152 m)

B. Spare and replacement parts shall be in original packaging and submitted to the COR.

C. Provide to the VA, all hardware, software, programming tools, license and documentation necessary to permanently modify the fire alarm system on site. The minimum level of modification includes addition and deletion of devices, circuits, zones and changes to system description, system operation, and digitized evacuation and instructional messages.

2.14 INSTRUCTION CHART:

Provide typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame with a backplate. Install the frame in a conspicuous location observable from each control unit where operations are performed. The card shall show those steps to be taken by an operator when a signal is received under all conditions, normal, alarm, supervisory, and trouble. Provide an additional copy with the binder for the input output matrix for the sequence of operation. The instructions shall be approved by the COR before being posted.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with NFPA 70, 72, 90A, and 101 as shown on the drawings, and as recommended by the major equipment manufacturer. Fire alarm wiring shall be installed in conduit. All conduit and wire shall be installed in accordance with, Section 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS, Section 26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS, and all penetrations of smoke and fire barriers shall be protected as required by Section 07 84 00, FIRESTOPPING. Provide wiring in conduit per manufacturer requirements.

B. All conduits, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.

C. All new and reused exposed conduits shall be painted in accordance with Section 09 91 00, PAINTING to match surrounding finished areas and red in unfinished areas.

D. All existing accessible fire alarm conduit not reused shall be removed.

E. Existing devices that are reused shall be properly mounted and installed. Where devices are installed on existing shallow backboxes, extension rings of the same material, color and texture of the new fire alarm devices shall be used. Mounting surfaces shall be cut and patched in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Restoration, and be re-painted in accordance with Section 09 91 00, PAINTING as necessary to match existing.

F. All fire detection and alarm system devices, control units and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Exact locations are to be approved by the COR.

G. Speakers shall be ceiling mounted and fully recessed in areas with suspended ceilings. Speakers shall be wall mounted and recessed in finished areas without suspended ceilings. Speakers may be surface mounted in unfinished areas.

H. Strobes shall be flush wall mounted with the bottom of the unit located 80 inches (2,000 mm) above the floor or 6 inches (150 mm) below ceiling, whichever is lower. Locate and mount to maintain a minimum 36 inches (900 mm) clearance from side obstructions.

I. Manual pull stations shall be installed not less than 42 inches (1,050 mm) or more than 48 inches (1,200 mm) from finished floor to bottom of device and within 60 inches (1,500 mm) of a stairway or an exit door.

J. Where possible, locate water flow and pressure switches a minimum of 12 inches (300 mm) from a fitting that changes the direction of the flow and a minimum of 36 inches (900 mm) from a valve.

K. Mount valve tamper switches so as not to interfere with the normal operation of the valve and adjust to operate within 2 revolutions toward the closed position of the valve control, or when the stem has moved no more than 1/5 of the distance from its normal position.

L. Connect flow and tamper switches installed under Section 21 13 16, DRY-PIPE SPRINKLER SYSTEMS.

3.2 TYPICAL OPERATION

A. Activation of any manual pull station, water flow or pressure switch, heat detector, kitchen hood suppression system, gaseous suppression system, or smoke detector shall cause the following operations to occur:

1. Continuously sound a temporal pattern general alarm and flash all strobes in the building in alarm until reset at the local fire alarm control unit in Buildings B120.
4. Transmit a separate alarm signal, via the main fire alarm control unit to the fire department.
5. Unlock the electrically locked exit doors within the zone of alarm.

B. Heat detectors in elevator machine rooms shall, in addition to the above functions, disconnect all power to all elevators served by that machine room after a time delay. The time delay shall be programmed within the fire alarm system programming and be equal to the time it takes for the car to travel from the highest to the lowest level, plus 10 seconds.

C. Smoke detectors in the main elevator lobby of Building B120 shall, in addition to the above functions, return elevator to the secondary floor.

D. Smoke detectors in the remaining elevator lobbies, elevator machine room, or top of hoistway shall, in addition to the above functions, return elevator to the primary floor.

E. Operation of duct smoke detectors shall cause a system supervisory condition and shut down the ventilation system and close the associated smoke dampers as appropriate.

G. Operation of any sprinkler or standpipe system valve supervisory switch, high/low air pressure switch, shall cause a system supervisory condition.

H. Alarm verification shall not be used for smoke detectors installed for the purpose of early warning.

3.3 TESTS

A. Provide the service of a NICET level III, competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the COR.

B. When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests in the presence of the COR. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meets all contract requirements. After the system has passed the initial test and been approved by the COR, the contractor may request a final inspection.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
3. Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.
4. Open each alarm initiating and notification circuit to see if trouble signal actuates.
5. Ground each alarm initiation and notification circuit and verify response of trouble signals.

3.4 FINAL INSPECTION AND ACCEPTANCE

A. Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last 14 days is without a system or equipment malfunction.

B. At the final inspection a factory trained representative of the manufacturer of the major equipment shall repeat the tests in Article 3.3 TESTS and those required by NFPA 72. In addition the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of a VA representative.

3.5 INSTRUCTION

A. The manufacturer's authorized representative shall provide instruction and training to the VA as follows:

1. 1-hour session to staff, security police and central attendant personnel for simple operation of the system after the completion of installation.

B. The Contractor and/or the Systems Manufacturer's representative shall provide a typewritten "Sequence of Operation" including a trouble shooting guide of the entire system for submittal to the VA. The sequence of operation will be shown for each input in the system in a matrix format and provided in a loose leaf binder. When reading the sequence of operation, the reader will be able to quickly and easily determine what output will occur upon activation of any input in the system. The INPUT/OUTPUT matrix format shall be as shown in Appendix A to NFPA 72.

C. Furnish the services of a competent instructor for instructing personnel in the programming requirements necessary for system expansion. Such programming shall include addition or deletion of devices, zones, indicating circuits and printer/display text.

- - END - -

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 D698 and or 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, proofrolling, or similar methods.
   3. Existing Subgrade (Footings Only): Same as paragraph 1, but no fill or backfill. If materials differ from reference borings and 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. Paving sub-grade requirements: Section 32 12 16, ASPHALT PAVING.

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. Rock Excavation:

1. Trenches and Pits: Removal and disposal of solid, homogenous, interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits that cannot be excavated with a late-model, track-mounted hydraulic excavator; equipped with a 42 inch wide, short-tip-radius rock bucket; rated at not less than 138 hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 19,000 lbf; measured according to SAE J-1179. Trenches in excess of 10 feet wide and pits in excess of 30 feet in either length or width are classified as open excavation.

2. Open Excavation: Removal and disposal of solid, homogenous, interlocking crystalline material firmly cemented, laminated, or foliated masses or conglomerate deposits that cannot be dislodged and excavated with a late-model, track-mounted loader; rated at not less than 210 hp flywheel power and developing a minimum of 48,510 lbf breakout force; measured according to SAE J-732.
3. Other types of materials classified as rock are unstratified masses, conglomerated deposits and boulders of rock material exceeding 1 cubic yard for open excavation, or 3/4 cubic yard for footing and trench excavation that cannot be removed by rock excavating equipment equivalent to the above in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted.

4. Definitions of rock and guidelines for equipment are presented for general information purposes only. The Contractor is expected to use the information presented in the Geotechnical Engineering Report to evaluate the extent and competency of the rock and to determine both quantity estimations and removal equipment and efforts.

1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:

A. Measurement: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. Quantities

should be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. The measurement will include authorized excavation for rock, authorized excavation of satisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow its, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to taking of elevations and measurements of the undisturbed grade.

1.6 SUBMITTALS:

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

B. Rock Excavation Report:
   1. Certification of rock quantities excavated.
   2. Excavation method.
   3. Labor.
   4. Equipment.
   5. Land Surveyor's or Civil Engineer's name and official registration stamp.
   6. Plot plan showing elevation.

C. 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 D698 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 5.5 lb Rammer and a 12 inch Drop

T180-10 ..... Standard Method of Test for Moisture-Density Relations of Soils using a 10 lb Rammer and a 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)

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)

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. 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 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 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 1 1/2-inch sieve and not more than 12 percent passing a No. 200 sieve, per ASTM D2940;.

D. 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 No. 200 sieve.

E. 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 1 1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

F. 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, No. 200 sieve and no more than 2 percent by weight passing the No. 4 size sieve
2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 1/2 inch to No 4, per ASTM D2940.

G. Requirements for Offsite Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

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 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 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 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 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 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 construction area.

B. Grubbing: Remove stumps and roots 3 inch and larger diameter. Undisturbed sound stumps, roots up to 3 inch diameter, and nonperishable solid objects a minimum of 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 15 feet of new construction and 7.5 feet of utility lines when removal is approved in advance by Resident Engineer. Remove materials from construction area. 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 1/2 cubic foot in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 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 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 construction area.

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 elevations indicated on plans 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.
4. Finish grading is specified in Section 32 90 00, PLANTING.

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. No burning of materials is permitted onsite.

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 in compliance with specifications Section 31 23 23.33, FLOWABLE FILL, under disturbed foundations, as directed by Resident Engineer, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by Resident Engineer.
5. The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall update the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least monthly, informing the Contractor and Resident Engineer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Geotechnical Engineer shall be available to meet with the Resident Engineer at any time throughout the contract duration.

B. Excavation Drainage: Operate pumping equipment and/or provide other materials, means and equipment as 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 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 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.

D. 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

E. 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.

F. 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 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 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade
   f. Bury detection wire directly above non-metallic piping at a distance not to exceed 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 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over it's entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.
   g. 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, 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 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.

2. Sanitary and storm sewer trenches:
   a. Trench width below a point 6 inches above top of pipe shall be 24 inches maximum for pipe up to and including 12 inches diameter, and four-thirds diameter of pipe plus 8 inches for pipe larger than 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 6 inches loose thickness.
      2) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 12 inches above top of pipe shall be clean earth placed and tamped by hand.
      3) Granular Fill: Depth of fill shall be a minimum of 3 inches plus one sixth of pipe diameter below pipe to 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 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade
   f. Bury detection wire directly above non-metallic piping at a distance not to exceed 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 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over it's entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.
   g. 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, 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 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.

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. Testing of the soil shall be performed by the VA Testing Laboratory. 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 1 inch.
      2) Walks: Plus or minus 1 inch.
      3) Pavements: Plus or minus 1 inch.
   d. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10 foot straightedge.

3.3 UNDERPINNING:

A. Design of the underpinning system is the responsibility of the Contractor and should be designed by a registered professional engineer and is subject to review and approval by the Resident Engineer. Underpinning of existing building foundations, as indicated on structural drawings, or where excavation undermines existing foundations, shall be accomplished in the following manner:

1. Make general excavation for new construction, where new foundations are to be below existing foundations, to elevation of new foundations (or sized stone subbase), maintaining a 45 degree sloped berm.
2. For underpinning pits, underpin existing wall foundations by excavating 4 feet wide pits to depth shown on drawings skipping 3 sections at any one time so as to maintain support for wall at all times.
3. Underpin intervening sections one at a time; no adjacent sections shall be underpinned until concrete in adjacent sections shall have reached 20 MPa (2500 psi) strength and have been dry packed with non-shrink grout to obtain positive bearing. Sheet and brace underpinning pits if soil will not stand on a vertical cut during this operation, or as required for safety of workmen. Repack any voids behind sheeting to prevent sloughing which could cause settlement of existing foundations. Contractor performing this portion of work shall have been prequalified by Resident Engineer as having previously performed successfully this type of work or will demonstrate his capability for successfully performing this work. It shall be sole responsibility of the Contractor to guard against objectionable movement or settlement and to preserve integrity of existing structures.
4. The tip elevation of the underpinning pits shall be a minimum of 3 feet below the adjacent excavation elevation.
5. Subgrades at the tip of the underpinning pit shall be clean, dry, and free of debris and shall be observed by the Resident Engineer prior to concrete placement.
6. Concrete shall not be free fall greater than 10 feet into the pit.

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 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 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 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 D698 or ASTM D1557 as specified below:

1. Fills, Embankments, and Backfill
   a. Under proposed structures, building slabs, steps, and paved areas, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material in accordance with ASTM D698 95 percent.
   b. Curbs, curbs and gutters, ASTM D698
   c. Under Sidewalks, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material in accordance with ASTM D698 95 percent.
   d. Landscaped areas, top 16 inches ASTM D698 85 percent.
   e. Landscaped areas, below 16 inches of finished grade ASTM D698 90 percent.
2. Natural Ground (Cut or Existing)
   a. Under building slabs, steps and paved areas, top 6 inches ASTM D698 95 percent.
   b. Curbs, curbs and gutters, top 6 inches, ASTM D698 95 percent.
   c. Under sidewalks, top 6 inches, ASTM D698 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 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 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 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 +/- 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 property.

B. Place excess excavated materials suitable for fill and/or backfill on site where directed.

C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

D. Segregate all excavated contaminated soil designated by the Resident Engineer from all other excavated soils, and stockpile on site on two 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 Property.

----- 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 wheel stops .
3. Pedestrian Pavement: Walks, grade slabs, lawn mower strips, pedestrian crossings, wheelchair curb ramps, terraces, steps, patios, and healing gardens .
4. Vehicular Pavement: Service courts, driveways, parking lots, and loading docks .
5. Equipment Pads: Oxygen storage, transformers, propane tanks, and generator pads .

1.2 RELATED REQUIREMENTS

A. Field Testing: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Step Nosings and Railings: Section 05 50 00, METAL FABRICATIONS.

C. Subgrade Preparation and Subbase Compaction: Section 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. C979/C979M-16 - Pigments for Integrally Colored Concrete.
14. C989/C989M-14 - Slag Cement for Use in Concrete and Mortars.
15. C1240-15 - Silica Fume Used in Cementitious Mixtures.
16. D1751-04(2013)e1 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
17. D5893/D5893M-10 - Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
18. D6690-15 - Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. Architect/Engineer.
   c. Inspection and Testing Agency.
   d. Contractor.
   e. Installer.
   f. Other installers responsible for adjacent and intersecting work, including excavation, plantings, traffic markings, and _____ .
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. Samples:

1. Exposed Aggregate Concrete Panel: 0.4 sq. m by 50 mm (4 sq. ft. by 2 inches) thick, 2 required, each color and finish.
2. Colored Concrete Panel: As specified in Section 09 06 00, SCHEDULE FOR FINISHES, with mix data.

E. Test reports: Certify products comply with specifications.

1. Concrete materials.
2. Select subbase materials.
3. Field test reports.

F. Certificates: Certify products comply with specifications.

1. Expansion joint filler.
2. Reinforcement.
3. Curing materials.
4. Concrete protective coating.

G. Qualifications: Substantiate qualifications comply with specifications.

1. Installer with project experience list .
2. Land surveyor.

H. Concrete mix design.

I. Select subbase job-mix design.

J. Proposed hot and cold weather concreting methods.

K. Land surveyor's construction staking notes, before placing concrete.

1. Identify discrepancies between field conditions and Drawings.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Regularly installs specified products.
2. Installed specified products with satisfactory service on five similar installations.
   a. Project Experience List: Provide contact names and addresses for completed projects.

B. Land Surveyor: Professional land surveyor or engineer registered to provide land surveys in jurisdiction where project is located.

C. Preconstruction Testing:

1. Engage independent testing laboratory to perform tests and submit reports.
   a. Deliver samples to laboratory in number and quantity required for testing.
2. Concrete mix design.
3. Select subbase job-mix design. Report the following:
   a. Material sources.
   b. Gradation.
   c. Plasticity index.
   d. Liquid limit.
   e. Laboratory compaction curves indicating maximum density at optimum moisture content.

1.7 DELIVERY

A. Deliver steel reinforcement to prevent damage.

B. Before installation, return or dispose of distorted or damaged steel reinforcement.

C. Bulk Products: Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.

1.8 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

A. Hot Weather Concreting Procedures: ACI 305R.

B. Cold Weather Concreting Procedures: ACI 306R.

1. Use non-corrosive, non-chloride accelerator admixture.
2. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II.

B. Pozzolans:

1. Fly Ash: ASTM C618, Class C or F including supplementary optional physical requirements.
2. Slag: ASTM C989/C989M; Grade 80, Grade 100 or Grade 120 .

3. Silica Fume: ASTM C1240.

C. Coarse Aggregate: ASTM C33/C33M; size _____ 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, Grade 280 (40); Grade 420 (60); Grade 520 (75); Grade 550 (80); Grade 690 (100); deformed.

I. Welded Wire Fabric: ASTM A1064/A1064M, plain; deformed; Grade 385 (56); Grade 450 (65); Grade 485 (70); Grade 500 (72.5); Grade 515 (75); Grade 533 (77.5); Grade 550 (80); sized as indicated.

J. Expansion Joint Filler: ASTM D1751.

K. Sheet Materials for Curing Concrete: ASTM C171.

L. Color Pigment: ASTM C979/C979M, colored and white powder pigments.

2.2 SELECT SUBBASE

A. Subbase: AASHTO M147; Grade A Grade B Grade C Grade D Grade E Grade F .

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 clear Type 1-D Type 2 ; liquid membrane forming type, without paraffin or petroleum.

2.5 CONCRETE MIXES

A. Design concrete mixes according to ASTM C94/C94M, Option C.

B. Concrete Type: Non-air-entrained 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. Land Surveyor: Establish control, alignment, and grade for forms and slip forming machine operations .

1. Notify Contracting Officer's Representative immediately when discrepancies exist between field conditions and drawings.
2. Correct discrepancies greater than 25 mm (1 inch) before placing concrete.

D. Form Tolerances:

1. Variation from Indicated Line: Maximum 6 mm (1/4 inch).
2. Variation from Indicated Grade: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).

3.4 PLACING REINFORCEMENT

A. Keep reinforcement clean from contamination preventing concrete bond.

B. Install reinforcement shown on drawings.

C. Support and securely tie reinforcing steel to prevent displacement during concrete placement.

D. Obtain Contracting Officer's Representative's reinforcement placement approval before placing concrete.

3.5 JOINTS - GENERAL

A. Place joints, where shown on approved submittal Drawings.

1. Conform to details shown.
2. Install joints perpendicular to finished concrete surface.

B. Make joints straight and continuous from edge to edge of pavement.

3.6 CONSTRUCTION JOINTS

A. Locate longitudinal and transverse 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.

G. Curb-Forming Machines: Curb-forming machines for constructing integral curbs curbs and gutter will be approved based on trial use on the project. When equipment produces unsatisfactory results, discontinue use of the equipment at any time during construction and accomplish work by hand method construction. Remove unsatisfactory work and reconstruct full length between regularly scheduled joints. Dispose of removed portions off the project site.

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 - PEDESTRIAN PAVEMENT

A. Walks, Grade Slabs, Lawn Mower Crossings, Wheelchair Curb Ramps, Terraces, Healing Gardens :

1. Finish concrete surfaces with metal float, troweled smooth, and finished with a broom moistened with clear water.
2. Finish slab edges and formed transverse joints with edger.
3. Broom surfaces transverse to traffic direction.
   a. Use brooming to eliminate flat surface produced by edger.
   b. Produce uniform corrugations, maximum 1.5 mm (1/16 inch) deep profile.
4. Provide surface uniform in color and free of surface blemishes, form marks, and tool marks.
5. Paving Tolerances:
   a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).
   b. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
6. Replace paving within joint boundary when paving exceeds specified tolerances.

B. Step Treads, Risers and Sidewalls: Finish as specified for pedestrian pavement, except as follows:

1. Remove riser forms sequentially, starting with top riser.
2. Rub riser face with wood or concrete rubbing block and water. Remove blemishes, form marks, and tool marks. Use outside edger to round nosing; use inside edger to finish bottom of riser.
3. Apply uniform brush finish to treads, risers, and sidewall.
   a. Apply stiff brush finish to treads to provide slip resistant surface complying with ANSI B101.3.
4. Step Tolerance:
   a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).

3.15 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.

3.16 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.

3.17 CONCRETE FINISHING - EQUIPMENT PADS

A. Strike pad surface to elevation shown on Drawings.

B. Provide smooth, dense float finish, free from depressions or irregularities.

C. Finish pad edges with edger.

D. After removing forms, rub pad edge faces with wood or concrete rubbing block, removing blemishes, form marks, and tool marks and providing uniform color.

E. Pad Tolerances:

1. Variation from Indicated Plane: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
2. Variation from Indicated Elevation: Maximum 6 mm (1/4 inch).
3. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).

F. Replace pads when pads exceed specified tolerances.

3.18 SPECIAL FINISHES

A. Exposed Aggregate Finish:

1. Prepare concrete base 10 to 13 mm (3/8 to 1/2 inch) lower than the finish grade.
2. Scatter aggregate over concrete base surface and embed by use of hand float, straight edge, or darby.
3. Apply concrete mix and mark off surface as indicated on Drawings with surface joints at least 10 mm (3/8 inch) deep. Level off finish to a true surface and compact with wood float, working as little as possible so that coarse material will remain at the top. Before finish has set, treat top surface with cement retarding material. When body of concrete finish has set, remove retarded surface film by wire brushes and fine water spray to remove mortar from top of colored aggregate. Continue washing and brushing until flush water runs clear and no noticeable cement film left on the aggregate.

B. Colored Concrete: Add integral color pigment to the pedestrian concrete paving mix at batch plant. Introduce sufficient quantities of carbon black mineral oxide pigment to produce color specified in Section 09 06 00, SCHEDULE FOR FINISHES.

3.19 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.

3.20 CONCRETE PROTECTIVE COATING

A. Apply protective coating of linseed oil mixture to exposed-to-view concrete surfaces, drainage structures, and features that project through, into, or against concrete exterior improvements to protect the concrete against deicing materials.

B. Complete backfilling and curing operation before applying protective coating.

C. Dry and thoroughly clean concrete before each application.

D. Apply two coats, with maximum coverage of 11 sq. m/L (50 sq. yds./gal.); first coat, and maximum 16 sq. m/L (70 sq. yds./gal.); second coat, except apply commercially prepared mixture according to manufacturer's instructions.

E. Protect coated surfaces from vehicular and pedestrian traffic until dry.

F. Do not heat protective coating, and do not expose protective coating to open flame, sparks, or fire adjacent to open containers or applicators. Do not apply material at temperatures lower than 10 degrees C (50 degrees F).

3.21 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

1. Compaction.
   a. Pavement subgrade.
   b. Curb, gutter, and sidewalk.
2. Concrete:
   a. Delivery samples.
   b. Field samples.
3. Slip Resistance: Steps and pedestrian paving.

3.22 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.

3.23 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 33 30 00

SANITARY SEWER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies materials and procedures for construction of outside, underground sanitary sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.

B. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

C. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATION.

D. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

E. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS

1.4 ABBREVIATIONS

A. PVC: Polyvinyl chloride plastic

B. DI: Ductile iron pipe

1.5 DELIVERY, STORAGE AND HANDLING

A. Store plastic piping protected from direct sunlight and support to prevent sagging and bending. Protect stored piping from moisture and dirt by elevating above grade. Protect flanges, fittings, and specialties from moisture and dirt.

B. Handle manholes according to manufacturer's written rigging instructions.

1.6 COORDINATION

A. Coordinate connection to sanitary sewer main with Public Utility company. (Approval from public utility has been obtained indicating that the downstream sanitary systems have sufficient capacity to handle the sanitary discharge from the facility.)

B. Contractor to obtain approval from the Public Agency that the existing sanitary sewer systems have the capacity to handle the discharge from the facility.

C. Coordinate exterior utility lines and connections to building lines up to 5 feet of building wall.

D. Coordinate connection to public sewer system with Public Utility Company.

1.7 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

1.8 SUBMITTALS:

A. Manufacturers' Literature and Data shall be submitted for the following as one package:

1. Pipe, Fittings, and, Appurtenances.
2. Jointing Material.
3. Manhole and Structure Material.
4. Frames and Covers.
5. Steps and Ladders.
6. Gate Valves.
7. Valve Boxes.
8. Check Valves.
9. Air Release Valves.
10. Acid Neutralization Tanks.

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 for Testing and Materials (ASTM):

A74-09.....Cast Iron Soil Pipe and Fittings

A185/A185M-07 .....Steel Welded Wire Reinforcement, Plain, for Concrete

A615/A615M-09b .....Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

A746-99.....Ductile-Iron Gravity Sewer Pipe

C478-09 .....Precast Reinforced Concrete Manhole Sections

C857-11 .....Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

C890-11 .....Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures

C913-08 .....Precast Concrete Water and Wastewater Structures

C923-08 ..... Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

C924-02(2009) ..... Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

C990-09 ..... Joints for Concrete Pipe, Manholes, and precast Box Sections using Preformed Flexible Joint Sealants

C1173-10 ..... Flexible Transition Couplings for Underground Piping Systems

C1440-08 ..... Thermoplastic Elastomeric (TPE) Gasket Materials for Drain, Waste and Vent (DWV), Sewer, Sanitary and Storm Plumbing Systems

C1460-08 ..... Shielded Transition Couplings for Use With Dissimilar DWV Pipe and Fittings Above Ground

C1461-08 ..... Mechanical Couplings Using Thermoplastic Elastomeric (TPE) Gaskets for Joining Drain, Waste and Vent (DWV), Sewer, Sanitary and Storm Plumbing systems for Above and below Ground Use

D2321-11 ..... Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D3034-08 ..... Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

F477-10 ..... Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679-08 ..... Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

F891-10 ..... Coextruded Poly(vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core

F949-10 ..... Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

F1417-11 ..... Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

F1668-08 ..... Construction Procedures for Buried Plastic Pipe

C. American Water Works Association (AWWA):

C105/A21.5-10 ..... Polyethylene Encasement for Ductile-Iron Pipe Systems

C110-08 ..... Ductile-Iron and Gray-Iron Fittings

C111/A21.11-06 ..... Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings

C151/A21.51-09 ..... Ductile Iron Pipe, Centrifugally Cast

C153/A21.53-06 ..... Ductile Iron Compact Fittings for Water Service

C219-11 ..... Bolted, Sleeve-Type Couplings for Plain-End Pipe

C512-07 ..... Air Release, Air/Vacuum and Combination Air Valves for Water Works Service

C600-10 ..... Installation of Ductile-Iron Mains and Their Appurtenances

C900-07 ..... Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution

D. American Society of Mechanical Engineers:

A112.14.1–2003 ..... Backwater Valves

A112.36.2M-1991 ..... Cleanouts

1.10 WARRANTY

A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year two years from final acceptance. Further, the Contractor will provide all manufacturers' and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements.

B. All pipe and fittings used in the construction of force mains shall be rated to meet the system maximum operating pressure with a minimum of 150 psi (1035 kPa).

C. The 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.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical Joint Piping

1. Pipe and Fittings: AWWA C151, thickness insert class unless otherwise shown or specified.
2. Compact Fittings: AWWA C153.
3. Gaskets: AWWA C111.

4. Exterior coating: AWWA C151.
5. Interior lining shall be as per ASTM A746.
6. Pipe and fittings shall be polyethylene encased as per AWWA C105.

B. Push-on-Joint Piping:

1. Pipe: AWWA C151, thickness insert class , with bolt holes in bell.
2. Standard Fittings: AWWA C110.
3. Compact Fittings: AWWA C153.
4. Gaskets: AWWA C111.
5. Exterior coating: AWWA C151.
6. Interior lining: AWWA C151.
7. Pipe and fittings shall be polyethylene encased as per AWWA C105.

2.3 PVC, GRAVITY SEWER PIPE AND FITTINGS

A. PVC Gravity Sewer Piping:

1. Pipe and Fittings shall conform to ASTM D3034 or ASTM F679 , SDR 35 SDR 26 .
2. Gaskets: ASTM F477.

B. PVC Cellular-Core Sewer Piping:

1. Pipe and Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D3034 ASTM F679 SDR 35 SDR 26.

C. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F949, corrugated pipe with bell and spigot ends.
2. Fittings: ASTM F949.
3. Gaskets: ASTM F477.

D. PVC Type PSM Sewer Piping:

1. Pipe shall conform to ASTM D3034 or ASTM F679 , SDR 35 SDR 26 .
2. Fittings: ASTM D3034.
3. Gaskets: ASTM F477.

2.4 PVC, PRESSURE PIPE AND FITTINGS

A. PVC:

1. Pipe: AWWA C900, Class 100 Class 150 and Class 200 PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, Class 100 Class 150 and Class 200 .
3. Gaskets: ASTM F477.

2.5 GRAVITY FLOW LINES WITH SECONDARY CONTAINMENT (ENCASEMENT)

A. Piping systems conveying hazardous materials shall be constructed with a watertight primary (carrier) pipe completely enclosed within a watertight secondary (containment) pipe.

B. Piping and fittings shall be as per ASTM D3034 AWWA C105 .

C. The carrier pipe shall be installed with manufactured spacers to maintain a minimum interstitial space of 0.75 inch (19 mm) between the carrier pipe and the containment pipe.

D. The encasement piping shall be equipped with adequate monitoring ports and vents to detect the presence of fluids within the containment pipe and for the extraction of fluids from the containment pipe.

E. Encasement pipe shall be bell and spigot with adhesive bond.

2.6 PVC PRESSURE (FORCE) MAIN:

A. Joints shall be fully restrained with mechanical joints, capable of restraining 50 percent above all loads acting on the joint, but not less than 150 psi (1035 kPa). Thrust blocks shall not be permitted.

B. Ductile iron pipe and fittings: AWWA C151.

1. Push-on joints shall be restrained by a mechanical restraint and prevent the opening of the joint.

C. Polyvinyl Chloride (PVC) Pipe and Fittings:

1. Pipe: ASTM D3034, SDR 35.
2. Gaskets: ASTM F477.

2.7 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve type, reducing or transition coupling, for joining underground nonpressure piping. Include ends to match same sizes of main line piping and install corrosion-resistant metal tension bands and tightening mechanism on each end.

B. Sleeve Materials:

1. For Plastic Pipes: ASTM F477, elastomeric seal.
2. For Dissimilar Pipes: PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Couplings shall be elastomeric sleeve with stainless steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Couplings shall meet ASTM C1460 with elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield with corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger mainline pipe and for spigot of smaller main line pipe to fit inside ring.

F. Nonpressure-Type, Rigid Couplings:

1. Coupling shall be ASTM C1461, sleeve-type, reducing- or transition-type mechanical coupling , molded from ASTM C1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.8 PRESSURE-TYPE PIPE COUPLINGS

A. Tubular-Sleeve Couplings:

1. Couplings shall meet AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

B. Metal, bolted, sleeve-type, reducing or transition couplings for joining underground pressure piping:

1. Couplings shall meet a 150-psi (1035-kPa) 200-psi (1380-kPa) insert value minimum pressure rating and ends of same sizes of the main line piping.

C. Center-Sleeve Material:

1. Sleeve shall be Manufacturer's standard Carbon steel Stainless steel Ductile iron Malleable iron .

D. Gasket material: Gaskets shall be natural or synthetic rubber.

E. Metal component finish: Finish shall be a corrosion-resistant material or coating.

2.9 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:

1. Compound fittings: Fittings shall have a combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or Insert number gasketed sleeve section s , rated for 250-psi (1725-kPa) minimum working pressure and for offset and expansion indicated.

B. Ductile-Iron Expansion Joints:

1. Jointing Material: Joints shall be a three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psi (1725-kPa) minimum working pressure and for expansion indicated.

C. Ductile-Iron Deflection Fittings:

1. Jointing Material: Compound coupling fittings with ball joint, flexing section, gaskets, and restrained-joint ends shall comply with AWWA C110 or AWWA C153. Include rating for 250-psi (1725-kPa) minimum working pressure and for up to 15 deg of deflection.

2.10 BACKWATER VALVES

A. Cast-Iron Backwater Valves:

1. Valve Material: Valve shall be as per ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
2. Horizontal type : Horizontal valve will include a swing check valve and hub-and-spigot ends.
3. Combination horizontal and manual gate-valve type : Valve will include a swing check valve, integral gate valve, and hub-and-spigot ends.
4. Terminal type : Valve will include a bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves:

1. PVC valve shall be a horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.11 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Cleanouts shall be as per ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Top-Loading Classification(s): Valve loadings shall be designed for Light Duty Medium Duty Heavy Duty and Extra-Heavy Duty .
3. Cleanout Riser: Sewer pipe fitting on main line pipe and riser shall be as per ASTM A74, service class.

B. PVC Cleanouts:

1. PVC body with PVC threaded plug: Cleanout shall be as per ASTM D3034. PVC sewer pipe fitting and riser to cleanout.
2. Cleanout Riser: Sewer pipe fitting on main line sewer and riser shall match main line piping.

2.12 MANHOLES

A. Standard precast concrete manholes and vaults shall be constructed of precast concrete segmental blocks, precast reinforced concrete rings, precast reinforced sections or cast-in-place concrete.

1. Precast Concrete Manholes: Material shall be as per ASTM C478, precast, reinforced concrete, of depth indicated, with sealed joints.
2. Concrete Base: Concrete for base of manhole shall have a minimum compressive strength of 5000 psi (35 MPa) at 28 days. Thickness to be 8 inches (200 mm), minimum.
3. Riser Section: 4 inch (100 mm) minimum thickness, of lengths to provide the total depth of manhole.
4. Top Section: Eccentric-cone type unless otherwise indicated. Top section to match adjustment ring configurations.
5. Joint Sealant: ASTM C990.
6. Resilient Pipe Connectors: ASTM C923.
7. Steps: If over 60 inches (1500 mm) in depth, individual FRP steps or ladder ASTM A615 deformed, 1/2 inch (13 mm) steel reinforcing rods encased in precast concrete sections insert material , with 16 inch (400 mm) minimum width, 12 to 16 inches (300 to 400 mm) center-to-center from top to bottom.
8. Adjusting Rings: Reinforced-concrete rings; 6 to 9 inch (150 to 225 mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Concrete Manholes:

1. Description: ASTM C913; designed according to ASTM C890 for AASHTO HS20-44, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: If over 60 inches (1500 mm) in depth, individual FRP steps or FRP ladder individual FRP steps, FRP ladder, or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in Insert material ; width 16 inches (400 mm) minimum, 12 to 16 inches (300 to 400 mm) center-to-center from top to bottom.
6. Adjusting Rings: Reinforced-concrete rings; 6 to 9 inch (150 to 225 mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Base Channels: Manhole channels shall be main line pipe material. Lay main pipe through manhole and cut top of pipe out to be three-fourths of pipe diameter. Slope through manhole to match run slopes of the main pipe.

2.13 CONCRETE

A. Cast-in-place concrete shall be 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

B. Reinforcement

1. Reinforcing fabric shall be ASTM A185, steel, welded wire fabric, plain.
2. Reinforcing bars shall be ASTM A615, Grade 60 (420 MPa) deformed steel.

C. Benches shall be concrete, sloped to drain into the channel. Provide 6 inches (150 mm) from the cut section of top of pipe to edge of manhole.

D. Ballast and Pipe Supports shall be Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

2.14 WET WELL

A. Fiberglass wet well. Tank shall be a single wall fiberglass reinforced plastic (FRP) UL labeled underground storage tanks as shown on the drawings. Size and fittings shall be as shown on drawings.

B. Concrete Wet Well:

1. Concrete wet well shall be a circular precast vault conforming to ASTM C857.
2. Vault Material: The vault shall have a poured concrete base with precast walls, and top poured in place structure.
3. Concrete: Concrete shall be 5000 psi (35 MPa) concrete at 28 days.

4. Design Load: The vault shall be rated for AASHTO HS20-44 loading and 30 percent impact loads.
5. Joints: Joints in the vault shall be tongue and groove. Flexible sealing compound, as recommended by the manufacturer, shall be placed in all joints to form a watertight structure.
6. Interior Coating: Concrete coating for the interior of wet wells shall consist of an epoxy blended filler sealer, and a cross linked epoxy phenolic cured, resistant protective coating.

C. Tank Design Criteria:

1. Internal Load: Tank shall withstand without leakage a 5 psi (34.5 kpa) air pressure test with 5 to 1 safety factor. Contractor shall test prior to installation as this is to test for leakage.
2. Vacuum Test: The tank shall be tested to 11.5 inches (292 mm) of mercury vacuum by the tank manufacturer to assure structural integrity. Contractor shall submit vacuum test certificate if test conducted by manufacturer at plant.
3. Surface Loading: Tank shall withstand surface AASHTO HS20-44 axle loads.
4. External Hydrostatic Pressure: Tank shall withstand 7 feet (2.1 m) of overburden with the hole fully flooded with a 3 to 1 safety factor against leaking.
5. Threaded fittings shall be of a material consistent with the requirements of the UL label and be of the sizes and locations shown on the drawings.
6. Tanks shall have nominal capacity as shown on drawings with a minimum of a 36 inch square (900 mm) ID manway riser, a complete cast iron frame and lid at finish grade, steps, and lid that is spring loaded.

2.15 ACID NEUTRALIZATION TANKS

A. Acid neutralization tanks shall be constructed of 1/4 inch (6 mm) plate, mild carbon steel suitable for rubber type lining with all welds double butt, continuous full welded, non porous and ground smooth and having no crevices, offsets or sharpened edges. The bottom and side walls shall be lined with 1/4 inch (6 mm) thermoplastic sheet lining fused directly to white ceramic lining 2 inches (50 mm) thick laid in Permamite acid and alkali proof mortar. The tank shall include 42 inch (1050 mm) ID manway riser constructed of steel shell with an interior corrosion resistant coating and complete cast iron frame and lid at the finish grade. Neutralizing charge shall be limestone, 3 inches (75 mm) in size.

2.16 OIL AND GREASE INTERCEPTOR AND GREASE REMOVAL PIT

A. Pit shall be constructed of reinforced precast concrete or cast-in-place concrete of the shape and configuration indicated on the plans. Precast vaults shall be constructed in accordance with ASTM C857 and be rated for AASHTO HS20-44 loading. The concrete shall have a minimum compressive strength of 5000 psi (35 MPa) at 28 days, and reinforcement shall comply with ASTM A615, Grade 60. Access to the pit shall be through 24 inches (600 mm) diameter manhole frame and cover or through hinged aluminum access manways.

B. Baffles shall be constructed of 1/4 inch (6 mm) mild carbon steel with 1/4 inch (6 mm) thermoplastic coating.

2.17 AIR RELEASE VALVE FOR FORCE MAINS

A. Valves shall be combination air release and vacuum valve with a single body. The valves shall be rated for 150 psi (1025 kPa) working pressure, and conform to AWWA C512. Valve shall be provided with threaded connections, and be mounted on a full opening ball valve to isolate the air release valve from the system.

2.18 WARNING TAPE

A. Warning tape shall be standard, 4 mil (0.1 mm) polyethylene 3 inch (76 mm) wide tape detectable non-detectable type, green with black letters and imprinted with “CAUTION BURIED SEWER LINE BELOW”.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans and details indicate the general location and arrangement of underground sanitary sewer piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at the low point, true to grades and alignment indicated on the drawings, with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.

D. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.

E. Inspect pipes and fittings for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.

F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.

G. Do not walk on pipe in trenches until covered by layers of bedding or backfill material to a depth of 12 inches (300 mm) over the crown of the pipe.

H. Warning tape shall be continuously placed 12 inches (300 mm) above sewer pipe

I. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

J. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

K. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process or microtunneling.

L. Install gravity-flow, non-pressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install piping with 36 inch (915 mm) 48 inch (1220 mm) 60 inch (1520 mm) 72 inch (1830 mm) Insert number minimum cover as shown on Drawings.
3. Install ductile iron, gravity sewer piping according to AWWA C600.
4. Install PVC cellular-core, PVC corrugated sewer, PSM sewer and PVC gravity sewer according to ASTM D2321 and ASTM F1668.

M. Install force-main, pressure piping according to the following:

1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fittings, or cast-in-place-concrete supports or anchors. Pressure (force) mains shall have the bells facing the direction of flow.
2. Sections of piping listed on the drawings shall be fully restrained. For devices with twist off nuts, the twist off nuts shall be placed on top of the fitting for the Resident Engineer's inspection. The Contractor shall torque test all bolts, set screws, identified by the Resident Engineer.
3. Thrust blocks shall not be permitted.

N. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

O. Gravity Flow Lines with Secondary Containment (Encasement Pipe):

1. Install per manufacturer's recommendations. Install all pipe centering devices to maintain an interstitial space below the invert of the carrier pipe. Both the carrier and containment pipe shall be tested for leaks.

3.2 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure, drainage piping according to the following:

1. Join ductile iron, gravity sewer piping according to AWWA C600 for push-on joints.
2. Join PVC piping according to ASTM D2321.
3. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

B. Join force-main, pressure piping according to the following:

1. Join ductile iron pressure piping according to AWWA C600 for push-on joints.
2. Join PVC pressure piping according to manufacturer's recommendations.
3. Join dissimilar pipe materials with pressure-type couplings.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use non-pressure flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.
   a. Unshielded Shielded Flexible or Rigid couplings for pipes of same or slightly different OD.
   b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
   c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure pipe couplings for force-main joints.

3.3 SEWER AND MANHOLE SUPPORTS, CONCRETE CRADLES WITHIN VAULTS

A. Install reinforced concrete as detailed on the drawings. The concrete shall not restrict access for future maintenance of the joints within the piping system.

3.4 BUILDING SERVICE LINES

A. Install sanitary sewer service lines to point of connection within approximately 5 feet (1500 mm) outside of building(s) where service is required and make connections. Coordinate the invert and location of the service line with the Contractor installing the building lines.

3.5 MANHOLE INSTALLATION

A. Install manholes complete with appurtenances and accessories indicated.
   1. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
   2. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top, shall be sealed as per manufacturer’s recommendations. Adjust the length of the rings so that the top section will be at the required elevation. Cutting the top section is not acceptable.
   3. Concrete manhole risers and tops: Install as specified.

B. Designed Concrete Structures:
   1. Concrete structures shall be installed in accordance with Section 03 30 00, CAST-IN-PLACE CONCRETE.

C. Do not build structures when air temperature is 32 deg F (0 deg C), or below.

D. The wall that supports access rungs or ladder shall be 90 deg vertical from the floor of structure to manhole cover.

E. Install steps and ladders per the manufacturer’s recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.

F. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. In unpaved areas, the rim elevation shall be 2 inches (50 mm) above the adjacent finish grade.

G. Install manhole frames and covers on a mortar bed, such that frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. Install an 8 inches (200 mm) thick, by 12 inches (300 mm) wide concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

3.6 WET WELLS

A. Install tank on a concrete pad as recommended by the manufacturer.

B. Installation of the tank and fittings shall be in accordance with the recommendations of the manufacturer.

C. In areas where the tank is subject to groundwater, the tank shall be anchored against floating as recommended by the manufacturer.

D. After installation, the inlets and outlets shall be plugged, and the tank completely filled with water. The tank shall have no leakage over a 48 hour period.

E. Top of wet well should be set a minimum of 6 inches (150 mm) above finish grade, unless in a traffic area, then it must match existing grade.

F. Install a 12 inches (300 mm) concrete ring around the fiberglass tank if in a grassed area.

G. All tank walls shall be level and plumb.

H. Seal all joints and depressions in the wet well.

I. Pipe and fittings entering and within the wet well shall be poly-lined ductile iron pipe.

J. All pipe penetrations through the walls of the wet well shall be sealed water tight.

3.7 OIL AND GREASE INTERCEPTOR AND GREASE REMOVAL PIT

A. Pipe and fittings shall be ductile iron poly-lined PVC , piping shall be used inside of trap, between trap and buildings, and between trap and manhole.

B. Manways and access manholes shall be set to finish grade providing adequate access to the unit. Slope pavement around the access-way to prevent stormwater from entering the unit.

C. Install baffles as indicated on the drawings.

3.8 ACID NEUTRALIZING TANKS

A. Set tank on aggregate base per the manufacturer’s recommendations.

B. Inspect interior and exterior of the tank and repair all damage to the lining. Place limestone in tank per manufacturer’s recommendations.

C. Backfill around tank with sand material.

3.9 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping manholes or pits.

B. Install combination horizontal and manual gate valves in piping and in manholes.

C. Install terminal-type backwater valves on end of piping and in manholes. Secure units to sidewalls.

3.10 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Cleanouts should be 6 inches (150 mm) in diameter and consist of a ductile iron 45 degree fitting on end of run, or combination Y fitting and l/8 bend in the run with ductile iron pipe extension, water tight plug or cap and cast frame and cover flush with finished grade. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete, 18 by 18 by 12 inches (450 by 450 by 300 mm) 1 inch (25 mm) above surrounding grade.

C. Where cleanout is in force main, provide a blind flange top connection. The center of the flange shall be equipped with a 2 inches (50 mm) base valve to allow the pressure in the line to be relieved prior to removal of the blind flange. Frames and covers for pressure (force) mains shall be 24 inches (600 mm) in diameter.

D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

E. The top of the cleanout assembly shall be 2 inches (50 mm) below the bottom of the cover to prevent loads being transferred from the frame and cover to the piping.

3.11 CONNECTIONS

A. Make connections to existing piping and underground manholes by coring and installing the pipe at the design invert. Install an elastomeric gasket around the pipe, and grout the interstitial space between the pipe and the core.

B. Connection to an existing manhole: The bench of the manhole shall be cleaned and reshaped to provide a smooth flowline for all new pipes connected to the manhole.

C. Use commercially manufactured wye fittings for piping branch connections. Encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

1. Make branch connections from the side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500), by removing a section of the existing pipe.
2. Make branch connections from the side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting an opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in concrete to provide additional support of collar from connection to undisturbed ground.

3. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.12 AIR RELEASE VALVES

A. Set valves in vault or force mains with adequate space for maintenance of the valve. The vault shall have a solid floor to prevent all sanitary blowoff from being absorbed into the soils.

B. Valves shall be set plumb and supported to the vault. Maintain accessibility to the isolation valve on the air valve line.

C. Install the valve after the completion of testing of the pressure (force) main.

3.13 REGRADING

A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Adjust the elevation of the cleanout pipe riser, and reinstall the cap or plug. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

3.14 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed.

1. Piping under and within 5 feet (1500 mm) of building areas shall be completely removed.
2. Piping outside of building areas shall be completely removed plugged with concrete, and abandoned in-place .

B. Excavate around manholes as required and use either procedure below:

1. Manholes and structures outside of building areas: Remove frame and cover, cut and remove the top of an elevation of 2 feet (600 mm) below finished grade. Fill the remaining portion with compacted gravel or crushed rock or concrete.
2. Manholes and structures with building areas: Remove frame and cover and remove the entire structure and the base.

C. Backfill to grade according to Division 31 Section 31 20 00, EARTH MOVING.

D. When the limit of the abandonment terminates in an existing manhole to remain, the flow line in the bench of the manhole to the abandoned line shall be filled with concrete and shaped to maintain the flowline of the lines to remain.

3.15 PIPE SEPARATION

A. Horizontal Separation - Water Mains and Sewers:

1. Existing and proposed water mains shall be at least 10 feet (3 m) horizontally from any proposed gravity flow and pressure (force main) sanitary sewer or sewer service connection.
2. Gravity flow mains and pressure (force) mains may be located closer than 10 feet (3 m) but not closer than 6 feet (1.8 m) to a water main when:
   a. Local conditions prevent a lateral separation of 10 feet (3 m); and
   b. The water main invert is at least 18 inches (450 mm) above the crown of the gravity sewer or 24 inches (600 mm) above the crown of the pressure (force) main; and the water main is in a separate trench separated by undisturbed earth.
3. When it is impossible to meet (1) or (2) above, both the water main and sanitary sewer main shall be constructed of push-on or mechanical joint ductile iron pipe.

B. Vertical Separation - Water Mains and Sewers at Crossings:

1. Water mains shall be separated from sewer mains so that the invert of the water main is a minimum of 24 inches (600 mm) above the crown of gravity flow sewer or 48 inches (1200 mm) above the crown of pressure (force) mains. The vertical separation shall be maintained within 10 feet (3 m) horizontally of the sewer and water crossing. When these vertical separations are met, no additional protection is required.
2. In no case shall pressure (force) sanitary main cross above, or within 24 inches (600 mm) of water lines.
3. When it is impossible to meet (1) above, the gravity flow sewer may be installed 18 inches (450 mm) above or 12 inches (300 mm) below the water main, provided that both the water main and sewer shall be constructed of push-on or mechanical ductile pipe. Pressure (Force) sewers may be installed 24 inches (600 mm) below the water line provided both the water line and sewer line are constructed of ductile iron pipe.
4. The required vertical separation between the sewer and the water main shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer line is at least 10 feet (3 m).

3.16 IDENTIFICATION

A. Install green warning tape directly over piping and at outside edges of underground manholes.

3.17 FIELD QUALITY CONTROL

A. All systems shall be inspected and obtain the Resident Engineer's approval. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.

B. To inspect, thoroughly flush out the lines and manholes before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lips at joints on the inside of gravity sewer lines are not acceptable.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

C. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
1. Test plastic gravity sewer piping according to ASTM F1417.
2. Test concrete gravity sewer piping according to ASTM C924.
3. Clean and isolate the section of sewer line to be tested. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. The line shall be pressurized to 4 psi (28 kPa) and allowed to stabilize. After pressure stabilization, the pressure shall be dropped to 3.5 psi (24 kPa) greater than the average back-pressure of any groundwater above the sewer.
4. For force mains, perform testing after supports and anchors are installed. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psi (1035 kPa).
5. Testing of Fiberglass Sewage Holding Tanks shall show no leakage during a 5 psi (35 kPa) air pressure test with 5:1 safety factor.
6. Testing of Concrete Wet Well shall show no leakage with the wet well completely filled with water for a duration of 4 hours.

3.18 CLEANING

A. Clean dirt and superfluous material from interior of piping.

--- E N D ---

SECTION 33 40 00

STORM SEWER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.

B. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 00, CAST-IN-PLACE CONCRETE.

C. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

D. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.

E. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

F. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS

1.4 ABBREVIATIONS

A. HDPE: High-density polyethylene

B. PE: Polyethylene

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Handle manholes catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.6 COORDINATION

A. Coordinate connection to storm sewer main with the Public Agency providing storm sewer off-site drainage.

B. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

1.7 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

1.8 SUBMITTALS

A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

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 for Testing and Materials (ASTM):

A185/A185M-07 ..... Steel Welded Wire Reinforcement, Plain, for Concrete

A242/A242M-04(2009)..... High-Strength Low-Alloy Structural Steel

A536-84(2009) ..... Ductile Iron Castings

A615/A615M-09b ..... Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

A760/A760M-10 ..... Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains

A798/A798M-07 ..... Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications

A849-10..... Post-Applied Coatings, Paving, and Linings for Corrugated Steel Sewer and Drainage Pipe

A929/A929M-01(2007)..... Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe

B745/B745M-97(2005)..... Corrugated Aluminum Pipe for Sewers and Drains

B788/B788M-09 ..... Installing Factory-Made Corrugated Aluminum Culverts and Storm Sewer Pipe

C14-07..... Non-reinforced Concrete Sewer, Storm Drain, and Culvert Pipe

C33/C33M-08..... Concrete Aggregates

C76-11..... Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

C139-10 ..... Concrete Masonry Units for Construction of Catch Basins and Manholes

C150/C150M-11..... Portland Cement

C443-10 ..... Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

C478-09 ..... Precast Reinforced Concrete Manhole Sections

C506-10b ..... Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe

C507-10b ..... Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe

C655-09 ..... Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe

C857-07 ..... Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

C891-09 ..... Installation of Underground Precast Concrete Utility Structures

C913-08 ..... Precast Concrete Water and Wastewater Structures

C923-08 ..... Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

C924-02(2009) ..... Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

C990-09 ..... Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

C1103-03(2009) ..... Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

C1173-08 ..... Flexible Transition Couplings for Underground Piping Systems

C1433-10 ..... Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers

C1479-10 ..... Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations

D448-08 ..... Sizes of Aggregate for Road and Bridge Construction

D698-07e1 ..... Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))

D1056-07 ..... Flexible Cellular Materials—Sponge or Expanded Rubber

D1785-06 ..... Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D2321-11 ..... Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2751-05 ..... Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings

D2774-08 ..... Underground Installation of Thermoplastic Pressure Piping

D3034-08 ..... Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

D3350-10 ..... Polyethylene Plastics Pipe and Fittings Materials

D3753-05e1 ..... Glass-Fiber-Reinforced Polyester Manholes and Wetwells

D4101-11 ..... Polypropylene Injection and Extrusion Materials

D5926-09 ..... Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

F477-10 ..... Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679-08 ..... Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

F714-10 ..... Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

F794-03(2009) ..... Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

F891-10 ..... Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core

F894-07 ..... Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

F949-10 ..... Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

F1417-11 ..... Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

F1668-08 ..... Construction Procedures for Buried Plastic Pipe

C. American Association of State Highway and Transportation Officials (AASHTO):

M190-04 ..... Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches

M198-10 ..... Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

M252-09 ..... Corrugated Polyethylene Drainage Pipe

M294-10 ..... Corrugated Polyethylene Pipe, 12 to 60 In. (300 to 1500 mm) Diameter

D. American Water Works Association(AWWA):

C105/A21.5-10 ..... Polyethylene Encasement for Ductile iron Pipe Systems

C110-08 ..... Ductile-Iron and Gray-Iron Fittings

C219-11 ..... Bolted, Sleeve-Type Couplings for Plain-End Pipe

C600-10 ..... Installation of Ductile iron Mains and Their Appurtenances

C900-07 ..... Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution

M23-2nd ed ..... PVC Pipe ”Design And Installation”

E. American Society of Mechanical Engineers (ASME):

A112.6.3-2001..... Floor and Trench Drains

A112.14.1-2003..... Backwater Valves

A112.36.2M-1991..... Cleanouts

F. American Concrete Institute (ACI):

318-05 ..... Structural Commentary and Commentary

350/350M-06 ..... Environmental Engineering Concrete Structures and Commentary

G. National Stone, Sand and Gravel Association (NSSGA): Quarried Stone for Erosion and Sediment Control

1.10 WARRANTY

The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year two years from final acceptance. Further, the Contractor will furnish all manufacturers’ and suppliers’ written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements. The 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.

2.2 STEEL PIPE AND FITTINGS

A. Steel pipe and fittings shall be as per ASTM A760.

B. Type of pipe: I II IR IIR .

C. Corrugations: Annular Helical 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.

D. Corrugations: Helical 3/4 by 3/4 by 7-1/2 inch (19 by 19 by 190 mm) corrugations.

E. Internal Coating: Internal coating shall be fully bituminous coated (AASHTO M190 Type A) half bituminous coated, part paved (AASHTO M190 Type B) fully bituminous coated, part paved (AASHTO M190 Type C) fully bituminous coated, fully paved (AASHTO M190 Type D) concrete lined as per ASTM A849 polymer precoated, part paved (AASHTO M190, Type B modified) polymer precoated, fully paved (AASHTO M190, Type D modified) .

F. Exterior Coating: Aluminum Zinc Polymer Coated.

G. Gaskets: ASTM D1056, Type 2, A1 B3 .

H. Connecting Bands: To be same type and size as the ends of the pipe being connected.

2.3 ALUMINUM PIPE AND FITTINGS

A. Corrugated aluminum pipe and fittings shall be ASTM B745, Type I with fittings of similar form and construction as pipe.

1. Special-joint bands shall be corrugated steel with O-ring seals.
2. Standard-joint bands shall be corrugated steel.

2.4 ABS PIPE AND FITTINGS

A. ABS Sewer Pipe and Fittings: Pipe and fittings shall conform to ASTM D2751, with bell-and-spigot ends for gasketed joints.

1. NPS 3 to NPS 6 (DN 80 to DN 150): SDR 35.
2. NPS 8 to NPS 12 (DN 200 to DN 300): SDR 42.

B. Gaskets: ASTM F477, elastomeric seals.

2.5 PE PIPE AND FITTINGS

A. Corrugated PE drainage pipe and fittings, NPS 3 to NPS 10 (DN 80 to DN 250); ASTM F714, SDR 21 with smooth waterway for coupling joints.

1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.

B. Corrugated PE pipe and fittings, NPS 12 to NPS 60 (DN 300 to DN 1500); AASHTO M294, Type S ASTM F714, SDR 21 for pipes 3 to 24 inches (300 to 600 mm) with smooth waterway for

coupling joints. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.

1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.
3. Water tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F477. Soil tight joints shall conform to requirements in AASHTO HB-17, Division II, for soil tightness and shall be as recommended by the manufacturer.

C. Profile Wall PE Pipe: Pipe shall comply with ASTM F894, Class 160.

1. Profile Wall PE Plastic Pipe Joints: Joints shall be as per ASTM F894, gasket or thermal weld type with integral bell.

D. PVC Pipe And Fittings

1. PVC Cellular-Core Pipe And Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D3034, SDR 35 Insert SDR , PVC socket-type fittings.

E. PVC Corrugated Sewer Piping

1. Pipe: ASTM F949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F477, elastomeric seals.

F. PVC Profile Sewer Piping

1. Pipe: ASTM F794, PVC profile, gravity sewer pipe with bell-and-spigot ends.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

G. PVC Type PSM Sewer Piping

1. Pipe: ASTM D3034, SDR 35 Insert SDR , PVC Type PSM sewer pipe with bell-and-spigot ends.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

H. PVC Gravity Sewer Piping

1. Pipe and fittings shall be ASTM F679, T-1 T-2 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends.
2. Gaskets: ASTM F477, elastomeric seals for gasketed joints.

I. PVC Pressure Piping

1. Pipe: AWWA C900, Class 100 Class 150 and Class 200 PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, Class 100 Class 150 and Class 200 PVC pipe with bell ends

3. Gaskets: ASTM F477, elastomeric seals.

2.6 CONCRETE PIPE AND FITTINGS

A. Non-Reinforced-Concrete sewer pipe and fittings shall be ASTM C14, Class 1 Class 2 Class 3 , with bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C443, rubber gaskets sealant joints with ASTM C990, bitumen or butyl-rubber sealant .

B. Reinforced-Concrete sewer pipe and fittings shall be ASTM C76 or ASTM C655.

1. Bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C443, rubber gaskets sealant joints with ASTM C990, bitumen or butyl-rubber sealant .
2. Class I: Wall A Wall B
3. Class II, Wall B
4. Class III: Wall A Wall B Wall C
5. Class IV: Wall A Wall B Wall C
6. Class V: Wall B Wall C

C. Reinforced arch culvert and storm drain pipe and fittings shall be ASTM C506, Class A-III A-IV and gasketed joints with ASTM C443, rubber gaskets sealant joints with ASTM C990, bitumen or butyl-rubber sealant .

D. Reinforced-Concrete elliptical culvert and storm drain pipe and fittings shall be ASTM C507, Class HE III HE IV VE III VE IV VE V VE VI and gasketed joints with ASTM C443, rubber gaskets sealant joints with ASTM C990, bitumen or butyl-rubber sealant .

2.7 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials

1. For concrete pipes: ASTM C443, rubber.
2. For plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
3. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.8 PRESSURE PIPE COUPLINGS

A. Couplings: AWWA C219, tubular-sleeve coupling, with center sleeve, gaskets, end rings, and bolt fasteners.

B. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 150-psi (1035-kPa) 200-psi (1380-kPa) Insert value minimum pressure rating and ends sized to match adjoining pipes.

C. Center-Sleeve Material: Carbon steel Stainless steel Ductile iron Malleable iron .

D. Gasket Material: Natural or synthetic rubber.

E. Metal Component Finish: Corrosion-resistant coating or material.

2.9 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile iron flexible expansion joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psi (1725-kPa) minimum working pressure and for offset and expansion indicated.

B. Ductile iron expansion joints: Three-piece assemblies of telescoping sleeve with gaskets and restrained-type, ductile iron or steel with protective coating , bell-and-spigot end sections complying with AWWA C110. Include rating for 250-psi (1725-kPa) minimum working pressure and for expansion indicated.

C. Ductile iron deflection fittings: Compound-coupling fitting, with ball joint, flexing section, gaskets, and restrained-joint ends, complying with AWWA C110. Include rating for 250-psi (1725-kPa) minimum working pressure and for up to 15 deg of deflection.

2.10 BACKWATER VALVES

A. Cast-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.

1. Horizontal type; with swing check valve and hub-and-spigot ends.
2. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
3. Terminal type; with bronze seat, swing check valve, and hub inlet.

B. Plastic backwater valves: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.11 CLEANOUTS

A. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Top-Loading Classification(s): Light Duty Medium Duty Heavy Duty and Extra-Heavy Duty
2. Pipe fitting and riser to cleanout shall be same material as main pipe line.

B. Plastic Cleanouts shall have PVC body with PVC threaded plug. Pipe fitting and riser to cleanout shall be of same material as main line pipe.

2.12 DRAINS

A. Cast-Iron Area Drains: ASME A112.6.3, gray-iron round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.

1. Top-Loading Classification(s): Medium Duty Medium and Heavy Duty Heavy Duty

B. Cast-Iron Trench Drains: ASME A112.6.3, 6 inch (150 mm) wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular secured grate. Include units of total length indicated and quantity of bottom outlets with inside calk or spigot connections, of sizes indicated.

1. Top-Loading Classification(s): Medium Duty Heavy Duty Extra-Heavy Duty Medium and Heavy Duty Medium and Extra-Heavy Duty Heavy and Extra-Heavy Duty Medium, Heavy, and Extra-Heavy Duty

C. Steel Trench Drains: ASTM A242, welded steel plate, to form rectangular body with uniform bottom downward slope of 2 percent toward outlet, anchor flange, and grate.

1. Plate Thicknesses: 1/8 inch (3.2 mm) and 1/4 inch (6.4 mm)
2. Overall Widths: 7-1/2 inches (190 mm) and 12-1/3 inches (313 mm)

D. Grate openings shall be 1/4 inch (6.4 mm) circular 3/8 inch (9.5 mm) circular or 3/8 by 3 inch (9.5 by 76 mm) slots .

2.13 ENCASEMENT FOR PIPING

A. Material: AWWA C105 Linear low-density polyethylene film of 0.008 inch (0.20 mm) or high-density, cross-laminated polyethylene film of 0.004 inch (0.10 mm) minimum thickness.

B. Form: Sheet or tube

C. Color: Black or natural Insert color

2.14 MANHOLES AND CATCH BASINS

A. Standard Precast Concrete Manholes:

1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6 inch (150 mm) minimum thickness for floor slab and 4-inch (102 mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4 inch (102 mm) minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.

7. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). Individual FRP steps or FRP ladder Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP , width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.
10. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C913; designed for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
5. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). Individual FRP steps or FRP ladder Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP ASTM A615 deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D 4101, PP , width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.
6. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

C. Fiberglass Manholes:

1. Description: ASTM D3753.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of concrete base as required to prevent flotation.
4. Base Section: Concrete, 8 inch (203 mm) minimum thickness.
5. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
6. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). Individual FRP steps or FRP ladder Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP

ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP , width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.

7. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

D. Manhole Frames and Covers:

1. Description: Ferrous; 24 inch (610 mm) ID by 7 to 9 inch (175 to 225 mm) riser with 4 inch (102 mm) minimum width flange and 26-inch (600 mm) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A536, Grade 60-40-18 ductile ASTM A48/A48M, Class 35 gray iron unless otherwise indicated.

2.15 CONCRETE FOR MANHOLES AND CATCH BASINS

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C150, Type II.
2. Fine Aggregate: ASTM C33, sand.
3. Coarse Aggregate: ASTM C33, crushed gravel.
4. Water: Potable.

B. Concrete Design Mix: 4000 psi (27.6 MPa) minimum, compressive strength in 28 days.

1. Reinforcing Fabric: ASTM A185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Channels shall be the main line pipe material. Include benches in all manholes and catch basins.

1. Channels: Main line pipe material or concrete invert. Height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope: Same slope as the main line pipe. Bench to be concrete, sloped to drain into channel. Minimum of 6 inch slope from main line pipe to wall sides.

2.16 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.

B. Sloped-Invert, Polymer-Concrete Systems:

1. Channel Sections:
   a. Interlocking-joint, precast, modular units with end caps.
   b. 4-inch (102 mm) inside width and deep, rounded bottom, with built-in invert slope of 0.6 percent and with outlets in quantities, sizes, and locations indicated.
   c. Extension sections necessary for required depth.

d. Frame: Include gray-iron or steel frame for grate.

2. Grates:

a. Manufacturer's designation " Heavy Medium Duty," with slots or perforations that fit recesses in channels.

b. Material: Fiberglass Galvanized steel Gray iron Stainless steel .

3. Covers: Solid gray iron if indicated.

4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

C. Narrow-Width, Level-Invert, Polymer-Concrete Systems:

1. Channel Sections:

a. Interlocking-joint, precast, modular units with end caps.

b. 5 inch (127 mm) inside width and 9-3/4 inch (248 mm) deep, rounded bottom, with level invert and with NPS 4 (DN 100) outlets in quantities, sizes, and locations indicated.

2. Grates:

a. Slots or perforations that fit recesses in channels.

b. Material: Fiberglass Galvanized steel Gray iron Stainless steel .

3. Covers: Solid gray iron if indicated.

4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

D. Wide-Width, Level-Invert, Polymer-Concrete Systems:

1. Channel Sections:

a. Interlocking-joint, precast, modular units with end caps.

b. 8 inch (203 mm) inside width and 13-3/4 inch (350 mm) deep, rounded bottom, with level invert and with outlets in quantities, sizes, and locations indicated.

2. Grates:

a. Slots or other openings that fit recesses in channels.

b. Material: Fiberglass Gray iron .

3. Covers: Solid gray iron if indicated.

4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

E. Drainage Specialties: Precast, polymer-concrete units.

1. Large Catch Basins:

a. 24 by 12 inch (610 by 305-mm) polymer-concrete body, with outlets in quantities and sizes indicated.

b. Gray-iron slotted grate.

c. Frame: Include gray-iron or steel frame for grate.

2. Small Catch Basins:

a. 19 to 24 inch by approximately 6 inch (483 to 610 mm by approximately 150 mm) polymer-concrete body, with outlets in quantities and sizes indicated.

b. Gray-iron slotted grate.

c. Frame: Include gray-iron or steel frame for grate.

3. Oil Interceptors:

a. Polymer-concrete body with interior baffle and four steel support channels and two 1/4 inch (6.4 mm) thick, steel-plate covers.

b. Steel-plate covers.

c. Capacity: 140 gal. (530 L) 200 gal. (757 L) 260 gal. (984 L) .

d. Inlet and Outlet: NPS 4 (DN 100) NPS 6 (DN 150) .

4. Sediment Interceptors:

a. 27 inch (686 mm) square, polymer-concrete body, with outlets in quantities and sizes indicated.

b. 24 inch (610 mm) square, gray-iron frame and slotted grate.

F. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.

G. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.17 PLASTIC, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Plastic, Channel Drainage Systems:

1. Modular system of plastic channel sections, grates, and appurtenances.

2. Designed so grates fit into frames without rocking or rattling.

3. Number of units required to form total lengths indicated.

B. Fiberglass Systems:

1. Channel Sections:

a. Interlocking-joint, fiberglass modular units, with built-in invert slope of approximately 1 percent and with end caps.

b. Rounded or inclined inside bottom surface, with outlets in quantities, sizes, and locations indicated.

c. Width: 6 inches (150 mm) 6 or 8 inches (150 or 203 mm) 8 inches (203 mm) .

2. Factory- or field-attached frames that fit channel sections and grates.

a. Material: Galvanized steel Stainless steel Manufacturer's standard metal .

3. Grates with slots or perforations that fit frames.

a. Material: Fiberglass Galvanized steel Gray iron Stainless steel .

4. Covers: Solid gray iron if indicated.

5. Drainage Specialties:

a. Large Catch Basins: 24 inch (610 mm) square plastic body, with outlets in quantities and sizes indicated. Include gray-iron frame and slotted grate.

b. Small Catch Basins: 12 by 24 inch (305 by 610 mm) plastic body, with outlets in quantities and sizes indicated. Include gray-iron frame and slotted grate.

C. PE Systems:

1. Channel Sections: Interlocking-joint, PE modular units, 4 inches (102 mm) wide, with end caps. Include rounded bottom, with level invert and with outlets in quantities, sizes, and locations indicated.
2. Grates: PE, ladder shaped; with stainless-steel screws.
3. Color: Gray unless otherwise indicated.
4. Drainage Specialties: Include the following PE components:
   a. Drains: 4 inch (102 mm) diameter, round, slotted top; with NPS 4 (DN 100) bottom outlet.
   b. Drains: 8 inch (203 mm) diameter, round, slotted top; with NPS 6 (DN 150) bottom outlet.
   c. Drains: 4 inch (102 mm) square, slotted top; with NPS 3 (DN 80) bottom outlet.
   d. Drains: 8 inch (203 mm) square, slotted top; with NPS 6 (DN 150) bottom outlet.
   e. Catch Basins: 12 inch (305 mm) square plastic body, with outlets in quantities and sizes indicated. Include PE slotted grate 11-3/4 inches (298 mm) square by 1-1/8 inches (28.6 mm) thick.

D. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.

E. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.18 PIPE OUTLETS

A. Head walls: Cast in-place reinforced concrete, with apron and tapered sides.

B. Riprap basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
1. Average Size: NSSGA No. R-3, screen opening 2 inches (51 mm).
2. Average Size: NSSGA No. R-4, screen opening 3 inches (76 mm).
3. Average Size: NSSGA No. R-5, screen opening 5 inches (127 mm).
4. Average Size: Insert size .

C. Filter Stone: NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.

D. Energy Dissipaters: To be as per NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton (2721-kg) average weight armor stone, unless otherwise indicated.

2.19 DRY WELLS

A. Concrete Well: ASTM C913, precast, reinforced, perforated concrete rings. Include the following:
1. Concrete Floor: 4000 psi (27.6 MPa) minimum 28 day compressive strength.
2. Cover: Liftoff-type concrete cover with cast in lift rings
3. Wall Thickness: 4 inches (102 mm) minimum with 1 inch (25 mm) diameter or 1 by 3 inch (25 by 76 mm) maximum slotted perforations arranged in rows parallel to axis of ring
4. Total free area of perforations: Approximately 15 percent of ring interior surface
5. Ring construction: Designed to be self-aligning.
6. Filtering material: ASTM D448, Size No. 24, 3/4 to 2-1/2 inch (19 to 63 mm) washed, crushed stone or gravel.

B. Manufacture PE side panels and top cover to assemble into 50 gal. (190 L) storage capacity units.

C. Constructed-in-place aggregate type well: Include the following:

1. Line with clay or concrete bricks.
2. Line with concrete blocks or precast concrete rings with notches or weep holes.
3. Filtering Material: ASTM D448, Size No. 24, 3/4 to 2-1/2 inch (19 to 63 mm) washed, crushed stone or gravel.
4. Cover: Precast, reinforced-concrete slab, designed for structural loading according to ASTM C890 and made according to ASTM C913. Include slab dimensions that extend 12 inches (300 mm) minimum beyond edge of excavation. Cast cover with opening for manhole in center.
5. Manhole: 24 inch (610 mm) diameter, reinforced-concrete access lid with steel lift rings. Include bituminous coating over entire surface.

2.20 STORMWATER DISPOSAL SYSTEMS

A. Chamber Systems:

1. Storage and leaching chambers: Molded PE with perforated sides and open bottom. Include number of chambers, distribution piping, end plates, and other standard components as required for system total capacity.
2. Filtering material: ASTM D448, Size No. 24, 3/4 to 2-1/2 inch (19 to 63 mm) washed, crushed stone or gravel. Include Geotextile woven or spun filter fabric, in one or more layers, for minimum total unit weight of 4 oz./sq. yd (135 g/sq. m).

B. Pipe Systems: Perforated manifold, header, and lateral piping complying with AASHTO M252 for NPS 10 (DN 250) and smaller, AASHTO M294 for NPS 12 to NPS 60 (DN 300 to DN 1500). Include fittings, couplings, seals, and filter fabric.

2.21 HEADWALLS

A. Headwalls: Cast in-place concrete with a minimum compressive strength of 3000 psi (20 MPa) at 28 days.

2.22 FLARED END SECTIONS

A. Flared End Sections: Sections shall be of standard design fabricated from zinc-coated steel sheets conforming to requirements of ASTM A929.

2.23 PRECAST REINFORCED CONCRETE BOX CULVERT

A. Precast Reinforced Concrete Box Culvert: Designed for highway loadings with 2 feet (600 mm) of cover or more subjected to dead load only, conforming to ASTM C1433. For less than 2 feet (600 mm) of cover, subjected to highway loading, conform to ASTM C1433.

2.24 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS

A. Resilient connectors and downspout boots: Flexible, watertight connectors used for connecting pipe to manholes and inlets, and shall conform to ASTM C923.

2.25 WARNING TAPE

A. Standard, 4-Mil polyethylene 3 inch (76 mm) wide tape detectable non-detectable type, green with black letters, and imprinted with “CAUTION BURIED STORM DRAIN LINE BELOW”.

PART 3 - EXECUTION

3.1 PIPE BEDDING

A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material. Corrugated metal pipe bedding requirements shall conform to ASTM A798.

3.2 PIPING INSTALLATION

A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping with 36 inch (915 mm) 48 inch (1220 mm) 60 inch (1520 mm) 72 inch (1830 mm) Insert dimension minimum cover as shown on the Drawings.

C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.

5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.
7. Warning tape shall be continuously placed 12 inches (300 mm) above storm sewer piping.

D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

G. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 (DN 150) Insert value and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
3. Install hub-and-spigot hubless , cast iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
4. Install ductile iron piping and special fittings according to AWWA C600.
5. Install corrugated steel piping according to ASTM A798.
6. Install corrugated aluminum piping according to ASTM B788.
7. Install ABS sewer piping according to ASTM D2321 and ASTM F1668.
8. Install PE corrugated sewer piping according to ASTM D2321 with gasketed joints gaskets with fused joints .
9. Install PVC cellular-core piping, PVC sewer piping, and PVC profile gravity sewer piping, according to ASTM D2321 and ASTM F1668.
10. Install non-reinforced-concrete reinforced concrete sewer piping according to ASTM C1479.
11. Install force-main pressure piping according to the following:
    a. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
    b. Install ductile iron pressure piping and special fittings according to AWWA C600.
    c. Install PVC pressure piping according to AWWA M23, or ASTM D2774 and ASTM F1668.
    d. Install corrosion-protection piping encasement over the following underground metal piping according to AWWA C105/A21.5.

1) Hub-and-spigot, cast iron soil pipe and fittings.
2) Hubless cast iron soil pipe and fittings.
3) Ductile iron pipe and fittings.
4) Expansion joints and deflection fittings.

3.3 REGRADING

A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

3.4 CONNECTIONS TO EXISTING VA-OWNED MANHOLES

A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping.

3.5 CONNECTIONS TO EXISTING PUBLIC UTILITY MANHOLES

A. Comply with all rules and regulations of the public utility.

B. Backwater Valve Installation

C. Install horizontal-type backwater valves combination horizontal and manual gate-valve terminal-type backwater valves in piping where indicated.

D. Cleanout Installation

1. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast iron soil pipe fittings in sewer pipes at branches for cleanouts and cast iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   a. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic Insert other areas.
   b. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic Insert other areas.
   c. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service Insert other areas.
   d. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads Insert area .
2. Set cleanout frames and covers in earth in cast in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) Insert dimensions deep. Set with tops 1 inch (25 mm) Insert dimension above surrounding earth grade.

E. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic Insert other areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic Insert other areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service Insert other areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads Insert area .

B. Embed drains in 4 inch (102 mm) minimum concrete around bottom and sides.

C. Set drain frames and covers with tops flush with pavement surface.

D. Assemble trench sections with flanged joints and embed trench sections in 4 inch (102 mm) Insert dimension minimum concrete around bottom and sides.

3.7 MANHOLE INSTALLATION

A. Install manholes, complete with appurtenances and accessories indicated. Install precast concrete manhole sections with sealants according to ASTM C891.

B. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) Insert dimension above finished surface elsewhere unless otherwise indicated.

C. Circular Structures:

1. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
2. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.
3. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

D. Rectangular Structures:

1. Precast concrete structures shall be placed on a 8 inch (200 mm) reinforced concrete pad, or be provided with a precast concrete base section. Structures provided with a base section shall be set on an 8 inch (200 mm) thick aggregate base course compacted to a minimum of

95 percent of the maximum density as determined by ASTM D698. Set precast section true and plumb. Seal all joints with preform flexible gasket material.

2. Do not build structures when air temperature is 32 deg F (0 deg C), or below.
3. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:
   a. Forming directly in concrete base of structure.
   b. Building up with brick and mortar.
4. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1 to 12 or more than 1 to 6. Bottom slab and benches shall be concrete.
5. The wall that supports access rungs or ladder shall be 90 deg vertical from the floor of structure to manhole cover.
6. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
7. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 2 inches (50 mm) above the adjacent finish grade. Install an 8 inch (203 mm) thick, by 12 inch (300 mm) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

3.8 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.9 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete.

B. Construct riprap of broken stone.

C. Install outlets that spill onto grade, anchored with concrete.

D. Install outlets that spill onto grade, with flared end sections that match pipe.

E. Construct energy dissipaters at outlets.

3.10 DRY WELL INSTALLATION

A. Excavate hole to diameter of at least 6 inches (150 mm) greater than outside of dry well. Do not extend excavation into ground-water table.

B. Install precast, concrete-ring dry wells according to the following:

1. Assemble rings to depth indicated, and extend rings to height where top of cover will be approximately 8 inches (203 mm) below finished grade.

2. Backfill bottom-inside of rings with filtering material to level at least 12 inches (300 mm) above bottom.
3. Extend effluent inlet pipe 12 inches (300 mm) into rings and terminate into side of tee fitting.
4. Backfill around outside of rings with filtering material to top level of rings and install cover over top of rings.

C. Install manufactured, PE dry wells according to manufacturer's written instructions and the following:

1. Assemble and install panels and cover.
2. Backfill bottom-inside of rings with filtering material to level at least 12 inches (300 mm) above bottom.
3. Extend effluent inlet pipe 12 inches (300 mm) into unit and terminate into side of tee fitting.
4. Install filter fabric around outside of unit.
5. Install filtering material around outside of unit.

D. Install constructed-in-place dry wells according to the following:

1. Install brick lining material dry and laid flat, with staggered joints for seepage. Build to diameter and depth indicated.
2. Install block lining material dry, with staggered joints and 20 percent minimum of blocks on side for seepage. Install precast concrete rings with notches or weep holes for seepage. Build to diameter and depth indicated.
3. Extend lining material to height where top of manhole will be approximately 8 inches (203 mm) Insert dimension below finished grade.
4. Backfill bottom of inside of lining with filtering material to level at least 12 inches (300 mm) above bottom.
5. Extend effluent inlet pipe 12 inches (300 mm) into lining and terminate into side of tee fitting.
6. Backfill around outside of lining with filtering material to top level of lining.
7. Install manhole over top of dry well. Support cover on undisturbed soil. Do not support cover on lining.

3.11 CHANNEL DRAINAGE SYSTEM INSTALLATION

A. Install with top surfaces of components, except piping, flush with finished surface.

B. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

C. Embed channel sections and drainage specialties in 4 inch (102 mm) Insert dimension minimum concrete around bottom and sides.

D. Assemble channel sections with flanged or interlocking joints.

E. Embed channel sections in 4 inch (102 mm) Insert dimension minimum concrete around bottom and sides.

3.12 STORMWATER DISPOSAL SYSTEM INSTALLATION

A. Chamber Systems: Excavate trenches of width and depth, and install system and backfill according to chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.

B. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill, according to piping manufacturer's written instructions.

3.13 CONNECTIONS

A. Connect nonpressure, gravity-flow force-main drainage piping in building's storm building drains specified in Division 22 Section FACILITY STORM DRAINAGE PIPING.

B. Encase entire connection fitting, plus 6 inch (150 mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping.
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
   a. Unshielded Shielded flexible couplings for same or minor difference OD pipes.
   b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
   c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

3.14 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8 inch (203 mm) Insert dimension thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches (915 mm) Insert dimension below final grade. Fill to within 12 inches (300 mm) Insert dimension of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 31 Section EARTH MOVING.

3.15 IDENTIFICATION

A. Install green warning tape directly over piping and at outside edge of underground structures.

3.16 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

3.17 TESTING OF STORM SEWERS:

A. Submit separate report for each test.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
4. Submit separate report for each test.
5. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.
6. Test force-main storm drainage piping. Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psi (1035 kPa) Insert value .
   a. Ductile iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
   b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.18 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water. Flush with water .

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