NEI
NORTHEAST INFRASTRUCTURE, LLC

SBA
U.S. Small Business Administration
SERVICE-DISABLED VETERAN-OWNED CERTIFIED



Correct Domestic Water System
Building 1 and 12
Project Number: 668-22-106
Construction Documents
Specifications

VA Spokane Health Care System
Mann-Grandstaff VA Medical Center
4815 North Assembly Street
Spokane, WA 99205-6185

Northeast Infrastructure, LLC
34 Brown Street
Honesdale, PA 18431
June 5, 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	01-24
01 33 23	Shop Drawings, Product Data, and Samples	11-23
01 35 26	Safety Requirements for Major Projects	05-24
01 42 19	Reference Standards	11-20
01 45 00	Quality Control	02-21
01 57 19	Temporary Environmental Controls	01-21
01 58 16	Temporary Interior Signage	07-15
01 74 19	Construction Waste Management	04-22
01 81 13	Sustainable Construction Requirements	10-17
01 91 00	General Commissioning Requirements	04-22
	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
	DIVISION 03 - CONCRETE	
	(Not Used)	
	DIVISION 04 - MASONRY	
04 20 00	Unit Masonry	08-17
	DIVISION 05 - METALS	
	(Not Used)	
	DIVISION 06 - WOOD, PLASTICS AND COMPOSITES	
	(Not Used)	
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION	
07 84 00	Firestopping	01-21
07 92 00	Joint Sealants	04-22

SECTION NO	DIVISION AND SECTION TITLES	DATE
	DIVISION 08 - OPENINGS	
	(Not Used)	
	DIVISION 09 – FINISHES	
09 29 00	Gypsum Board	04-20
09 51 00	Acoustical Ceilings	12-18
09 91 00	Painting	01-21
	DIVISION 10 – SPECIALTIES	
	(Not Used)	
	DIVISION 11 – EQUIPMENT	
	(Not Used)	
	DIVISION 12 – FURNISHINGS	
	(Not Used)	
	DIVISION 13 - SPECIAL CONSTRUCTION	
13 05 41	Seismic Restraint Requirements for Non-Structural Components	01-21
	DIVISION 14– CONVEYING EQUIPEMENT	
	(Not Used)	
	DIVISION 21- FIRE SUPPRESSION	
	(Not Used)	
	DIVISION 22 – PLUMBING	
22 05 11	Common Work Results for Plumbing	01-23
22 05 19	Meters and Gages for Plumbing Piping	09-20
22 05 23	General-Duty Valves for Plumbing Piping	09-20
22 07 11	Plumbing Insulation	09-19
22 08 00	Commissioning of Plumbing Systems	11-16
22 08 16	Disinfection of Potable Water Piping	12-25
22 11 00	Facility Water Distribution	05-21
22 13 00	Facility Sanitary and Vent Piping	09-20

SECTION NO	DIVISION AND SECTION TITLES	DATE
	DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)	
23 09 23	Direct-Digital Control System for HVAC	03-23
	DIVISION 25 – INTEGRATED AUTOMATION	
	(Not Used)	
	DIVISION 26 – ELECTRICAL	
26 05 11	Requirements for Electrical Installations	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 24 16	Panelboards	11-22
26 27 26	Wiring Devices	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 08 00	Commissioning of Communications Systems	11-16
27 10 00	Control, Communication and Signal Wiring	06-15
27 11 00	Telecommunications Room Fittings	06-15
27 15 00	Communications Structured Cabling	01-16
	DIVISION 28 – ELECTRONIC SAFETY AND SECURITY	
	(Not Used)	
	DIVISION 31 – EARTHWORK	
	(Not Used)	
	DIVISION 32 – EXTERIOR IMPROVEMENTS	
	(Not Used)	
	DIVISION 33 – UTILITIES	
	(Not Used)	
	DIVISION 34 – TRANSPORTATION	
	(Not Used)	

SECTION NO	DIVISION AND SECTION TITLES	DATE
	DIVISION 48 – ELECTRICAL POWER GENERATION	
	(Not Used)	

SECTION 00 01 15
LIST OF DRAWINGS

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

Drawing No.	Title
	GENERAL:
GI-01	COVER SHEET
	CIVIL:
CS-01	CAMPUS SITE PLAN
	ICRA:
ICRA-00	ICRA TEMPLATE & GENERAL REQUIREMENTS
ICRA-01	ICRA SAMPLE FORM: TYPE A DEADLEG REMEDIATION LOW-HIGH RISK
ICRA-02	ICRA SAMPLE FORM: TYPE A DEADLEG REMEDIATION HIGHEST RISK
ICRA-03	ICRA SAMPLE FORM: TYPE B DEADLEG REMEDIATION HIGHEST RISK
ICRA-04	ICRA GENERAL NOTES & DETAILS
ICRA-100	BUILDING 1 BASEMENT ICRA CLASSIFICATION PLAN
ICRA-101	BUILDING 1 FIRST FLOOR ICRA CLASSIFICATION PLAN
ICRA-102	BUILDING 1 SECOND FLOOR ICRA CLASSIFICATION PLAN
ICRA-103	BUILDING 1 THIRD FLOOR ICRA CLASSIFICATION PLAN
ICRA-104	BUILDING 1 FOURTH FLOOR ICRA CLASSIFICATION PLAN
ICRA-105	BUILDING 1 FIFTH FLOOR ICRA CLASSIFICATION PLAN
ICRA-106	BUILDING 1 SIXTH FLOOR ICRA CLASSIFICATION PLAN
ICRA-107	BUILDING 1 SEVENTH FLOOR ICRA CLASSIFICATION PLAN
ICRA-108	BUILDING 1 EIGHTH FLOOR ICRA CLASSIFICATION PLAN
ICRA-109	BUILDING 1 NINTH AND TENTH FLOOR ICRA CLASSIFICATION PLANS
ICRA-110	BUILDING 12 FIRST FLOOR AND MEZZANINE ICRA CLASSIFICATION PLANS

Drawing No.	Title
	PHASE:
GC-001	GENERAL PHASING SYMBOLS, NOTES, & SCHEDULES
GC-100	BUILDING 1 BASEMENT PHASING PLANS
GC-101	BUILDING 1 FIRST FLOOR PHASING PLANS
GC-102	BUILDING 1 SECOND FLOOR PHASING PLAN
GC-103	BUILDING 1 THIRD FLOOR PHASING PLAN
GC-104	BUILDING 1 FOURTH FLOOR PHASING PLAN
GC-105	BUILDING 1 FIFTH FLOOR PHASING PLAN
GC-106	BUILDING 1 SIXTH FLOOR PHASING PLAN
GC-107	BUILDING 1 SEVENTH FLOOR PHASING PLAN
GC-108	BUILDING 1 EIGHTH FLOOR PHASING PLAN
GC-109	BUILDING 1 NINTH AND TENTH FLOOR PHASING PLANS
	HAZARDOUS MATERIAL:
HA-001	GENERAL ASBESTOS NOTES
HA-100	BUILDING 1 BASEMENT HAZARDOUS MATERIAL PLANS
HA-101	BUILDING 1 FIRST FLOOR HAZARDOUS MATERIAL PLANS
HA-102	BUILDING 1 EIGHTH FLOOR HAZARDOUS MATERIAL PLANS
HA-103	BUILDING 1 NINTH FLOOR HAZARDOUS MATERIAL PLAN
	PLUMBING:
PL-001	GENERAL PLUMBING NOTES
PL-002	GENERAL PLUMBING SYMBOLS & ABBREVIATIONS
PL-003	PLUMBING SCHEDULES 1
PL-004	PLUMBING SCHEDULES 2
PL-005	PLUMBING SCHEDULES 3
PL-006	PLUMBING SCHEDULES 4
PD-100	BUILDING 1 BASEMENT WING A PLUMBING DEMOLITION PLAN
PD-101	BUILDING 1 BASEMENT WING B PLUMBING DEMOLITION PLANS
PD-102	BUILDING 1 BASEMENT WING C PLUMBING DEMOLITION PLAN
PD-102S	BUILDING 1 BASEMENT PLUMBING DEMOLITION SCHEDULES

Drawing No.	Title
	PLUMBING CONTINUED:
PD-103	BUILDING 1 FIRST FLOOR WING A PLUMBING DEMOLITION PLAN
PD-104	BUILDING 1 FIRST FLOOR WING B PLUMBING DEMOLITION PLAN
PD-105	BUILDING 1 FIRST FLOOR WING C PLUMBING DEMOLITION PLAN
PD-105S	BUILDING 1 FIRST FLOOR PLUMBING DEMOLITION SCHEDULES
PD-106	BUILDING 1 SECOND FLOOR WING A PLUMBING DEMOLITION PLAN
PD-107	BUILDING 1 SECOND FLOOR WING B PLUMBING DEMOLITION PLAN
PD-108	BUILDING 1 SECOND FLOOR WING C PLUMBING DEMOLITION PLAN
PD-108S	BUILDING 1 SECOND FLOOR PLUMBING DEMOLITION SCHEDULES
PD-109	BUILDING 1 THIRD FLOOR WING A & B PLUMBING DEMOLITION PLAN
PD-110	BUILDING 1 THIRD FLOOR WING C PLUMBING DEMOLITION PLAN
PD-110S	BUILDING 1 THIRD FLOOR PLUMBING DEMOLITION SCHEDULES
PD-111	BUILDING 1 FOURTH FLOOR WING A & B PLUMBING DEMOLITION PLAN
PD-112	BUILDING 1 FOURTH FLOOR WING C PLUMBING DEMOLITION PLAN
PD-112S	BUILDING 1 FOURTH FLOOR PLUMBING DEMOLITION SCHEDULES
PD-113	BUILDING 1 FIFTH FLOOR PLUMBING DEMOLITION PLAN
PD-113S	BUILDING 1 FIFTH FLOOR PLUMBING DEMOLITION SCHEDULES
PD-114	BUILDING 1 SIXTH FLOOR PLUMBING DEMOLITION PLAN
PD-114S	BUILDING 1 SIXTH FLOOR PLUMBING DEMOLITION SCHEDULES

Drawing No.	Title
	PLUMBING CONTINUED:
PD-115	BUILDING 1 SEVENTH FLOOR PLUMBING DEMOLITION PLAN
PD-115S	BUILDING 1 SEVENTH FLOOR PLUMBING DEMOLITION SCHEDULES
PD-116	BUILDING 1 EIGHTH FLOOR PLUMBING DEMOLITION PLAN
PD-116S	BUILDING 1 EIGHTH FLOOR PLUMBING DEMOLITION SCHEDULES
PD-117	BUILDING 1 NINTH AND TENTH FLOORS PLUMBING DEMOLITION PLANS
PD-117S	BUILDING 1 NINTH AND TENTH FLOORS PLUMBING DEMOLITION SCHEDULES
PD-118	BUILDING 12 FIRST FLOOR AREA 1 PLUMBING DEMOLITION PLAN
PD-119	BUILDING 12 FIRST FLOOR AREA 2 PLUMBING DEMOLITION PLAN
PD-120	BUILDING 12 FIRST FLOOR AREA 3 PLUMBING DEMOLITION PLAN
PD-121	BUILDING 12 MEZZANINE PLUMBING DEMOLITION PLANS
PD-121S	BUILDING 12 PLUMBING DEMOLITION SCHEDULES
PL-100	BUILDING 1 BASEMENT WING A PLUMBING NEW WORK PLAN
PL-101	BUILDING 1 BASEMENT WING B PLUMBING NEW WORK PLANS
PL-102	BUILDING 1 BASEMENT WING C PLUMBING NEW WORK PLAN
PL-102S	BUILDING 1 BASEMENT PLUMBING NEW WORK SCHEDULES
PL-103	BUILDING 1 FIRST FLOOR WING A PLUMBING NEW WORK PLAN
PL-104	BUILDING 1 FIRST FLOOR WING B PLUMBING NEW WORK PLAN
PL-105	BUILDING 1 FIRST FLOOR WING C PLUMBING NEW WORK PLAN
PL-105S	BUILDING 1 FIRST FLOOR PLUMBING NEW WORK SCHEDULES

Drawing No.	Title
	PLUMBING CONTINUED:
PL-106	BUILDING 1 SECOND FLOOR WING A PLUMBING NEW WORK PLAN
PL-107	BUILDING 1 SECOND FLOOR WING B PLUMBING NEW WORK PLAN
PL-108	BUILDING 1 SECOND FLOOR WING C PLUMBING NEW WORK PLAN
PL-108S	BUILDING 1 SECOND FLOOR PLUMBING NEW WORK SCHEDULES
PL-109	BUILDING 1 THIRD FLOOR WING A & B PLUMBING NEW WORK PLAN
PL-110	BUILDING 1 THIRD FLOOR WING C PLUMBING NEW WORK PLAN
PL-110S	BUILDING 1 THIRD FLOOR PLUMBING NEW WORK SCHEDULES
PL-111	BUILDING 1 FOURTH FLOOR WING A & B PLUMBING NEW WORK PLAN
PL-112	BUILDING 1 FOURTH FLOOR WING C PLUMBING NEW WORK PLAN
PL-112S	BUILDING 1 FOURTH FLOOR PLUMBING NEW WORK SCHEDULES
PL-113	BUILDING 1 FIFTH FLOOR PLUMBING NEW WORK PLAN
PL-113S	BUILDING 1 FIFTH FLOOR PLUMBING NEW WORK SCHEDULES
PL-114	BUILDING 1 SIXTH FLOOR PLUMBING NEW WORK PLAN
PL-114S	BUILDING 1 SIXTH FLOOR PLUMBING NEW WORK SCHEDULES
PL-115	BUILDING 1 SEVENTH FLOOR PLUMBING NEW WORK PLAN
PL-115S	BUILDING 1 SEVENTH FLOOR PLUMBING NEW WORK SCHEDULES
PL-116	BUILDING 1 EIGHTH AND NINTH FLOOR PLUMBING NEW WORK PLANS
PL-116S	BUILDING 1 EIGHTH AND NINTH FLOOR PLUMBING NEW WORK SCHEDULES
PL-117	BUILDING 12 FIRST FLOOR AREA 1 PLUMBING NEW WORK PLAN

Drawing No.	Title
	PLUMBING CONTINUED:
PL-118	BUILDING 12 FIRST FLOOR AREA 2 PLUMBING NEW WORK PLAN
PL-119	BUILDING 12 FIRST FLOOR AREA 3 PLUMBING NEW WORK PLAN
PL-120	BUILDING 12 MEZZANINE PLUMBING NEW WORK PLANS
PL-120S	BUILDING 12 PLUMBING NEW WORK SCHEDULES
PL-500	PLUMBING DETAILS 1
PL-501	PLUMBING DETAILS 2
PL-502	PLUMBING DETAILS 3
PL-503	PLUMBING DETAILS 4
TM-500	WATER MONITORING CONTROLS SCHEMATICS 1
TM-501	WATER MONITORING CONTROLS SCHEMATICS 2
	ELECTRICAL:
E-001	ELECTRICAL SYMBOLS, NOTES & ABBREVIATIONS
ED-100	BUILDING 1 BASEMENT WING B ELECTRICAL DEMOLITION PLAN
ED-101	BUILDING 1 BASEMENT WING C ELECTRICAL DEMOLITION PLAN
ED-102	BUILDING 12 MEZZANINE ELECTRICAL DEMOLITION PLAN
E-100	BUILDING 1 BASEMENT WING B ELECTRICAL NEW WORK PLAN
E-101	BUILDING 1 BASEMENT WING C ELECTRICAL NEW WORK PLAN
E-102	BUILDING 1 FIRST, SECOND & THIRD FLOOR ELECTRICAL NEW WORK PLANS
E-103	BUILDING 1 SIXTH FLOOR ELECTRICAL NEW WORK PLAN
E-104	BUILDING 1 SEVENTH & NINTH FLOOR ELECTRICAL NEW WORK PLANS
E-105	BUILDING 12 MEZZANINE ELECTRICAL NEW WORK PLAN
E-500	ELECTRICAL DETAILS
E-600	ELECTRICAL SCHEDULES 1
E-601	ELECTRICAL SCHEDULES 2

- - - E N D - - -

SECTION 01 00 00

GENERAL REQUIREMENTS

TABLE OF CONTENTS

1.1 SAFETY REQUIREMENTS..... 3
1.2 GENERAL INTENTION..... 3
1.3 STATEMENT OF BID ITEM(S)..... 3
1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR..... 5
1.5 CONSTRUCTION SECURITY REQUIREMENTS..... 5
1.6 OPERATIONS AND STORAGE AREAS..... 9
1.7 ALTERATIONS..... 14
1.8 DISPOSAL AND RETENTION..... 15
1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS..... 16
1.10 RESTORATION..... 16
1.11 LAYOUT OF WORK – NOT USED..... 17
1.12 AS-BUILT DRAWINGS..... 17
1.13 WARRANTY MANAGEMENT..... 18
1.14 USE OF ROADWAYS..... 20
1.15 SITE INFORMATION..... 21
1.16 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT..... 21
1.17 TEMPORARY USE OF EXISTING ELEVATORS..... 22
1.18 TEMPORARY USE OF NEW ELEVATORS (NOT USED)..... 22
1.19 TEMPORARY TOILETS..... 22
1.20 AVAILABILITY AND USE OF UTILITY SERVICES..... 23
1.21 NEW TELEPHONE EQUIPMENT – NOT USED..... 24
1.22 TESTS..... 24
1.23 INSTRUCTIONS..... 25
1.24 GOVERNMENT-FURNISHED EQUIPMENT – NOT USED..... 26
1.25 RELOCATED ITEMS..... 26
1.26 STORAGE SPACE FOR DEPARTMENT OF VETERANS AFFAIRS EQUIPMENT – NOT USED. 27
1.27 CONSTRUCTION SIGN..... 27
1.28 SAFETY SIGN..... 27
1.29 PHOTOGRAPHIC DOCUMENTATION..... 27
1.30 DIGITAL IMAGES - NOT USED..... 27
1.31 HISTORIC PRESERVATION - NOT USED..... 27

1.32 VA TRIRIGA CPMS - NOT USED..... 27
1.33 IDENTIFICATION..... 27
1.34 EMERGENCY MANAGMENT..... 27
1.35 SCHEDULE AND FAILURE TO ACHIEVE PROGRESS..... 28
1.36 GREEN ENVIRONMENTAL MANAGEMENT SYSTEM (GEMS)..... 29

SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 SAFETY REQUIREMENTS

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 the VA as required by drawings and specifications.

B. Visits to the site by Bidders may be made only during the published site walk or by appointment with the contracting officer representative (COR).

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

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

E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.

1.3 STATEMENT OF BID ITEM(S)

A. ITEM I, GENERAL CONSTRUCTION: Work includes general construction, and necessary removal of existing structures and construction and certain other items. This also includes removal/remediation of asbestos containing materials and lead based paint as indicated by corresponding specifications and hazardous materials drawings.

B. ITEM II, MECHANICAL/PLUMBING WORK: Work includes all labor, material, equipment, and supervision to perform the required mechanical/plumbing

construction work on this project. Including but not limited to dead leg removal, installation of automatic flushing faucets, installation of temperature sensors, installation of check valves, installation of flow meters, installation of mixing valves, installation of pressure sensors, installation of water monitoring panels, installation of sub micron legionella filters, insulation, valve replacement, and installation of water monitoring equipment.

C. ITEM III, ELECTRICAL WORK: work includes all labor, material, equipment, and supervision to perform the required electrical construction work on this project. Including electrical connections, devices, panels, conduits, and wiring for equipment identified in the contract documents.

D. ALTERNATE NO.1: BASE BID except omit work indicated in contract drawings identified as being included in bid alternate 1. This includes work related to the installation of pressure sensors in Building 1 Basement identified on separate bid deduct alternate schedule, installation of pressure sensors in Building 1 Floor 1 identified on separate bid deduct alternate schedule, installation of pressure sensors in Building 1 Floor 2 identified on separate bid deduct alternate schedule, the installation of pressure sensors in Building 1 Floor 3 identified on separate bid deduct alternate schedule, the installation of pressure sensors in Building 1 Floor 5 identified on separate bid deduct alternate schedule, the installation of temperature sensors in Building 1 Basement identified on separate bid deduct alternate schedule, the installation of temperature sensors in Building 1 Floor 2 identified on separate bid deduct alternate schedule, and the installation of temperature sensors in Building 1 Floor 3 identified on separate bid deduct alternate schedule.

E. ALTERNATE NO.2: BASE BID except omit work indicated to be part of bid deduct alternate 2 on drawings PD-118, PD-120, PL-117, and PL-119. This includes work related demolition in areas of Building 12 as identified on drawings PD-118 and PD-120 by the bid deduct alternate keyed note. This also includes work related to the installation of check valves, point of use filtration, temperature sensors, and pressure sensors identified on drawings PL-117 and PL-119 and in separate corresponding bid deduct alternate schedules.

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. The plan shall be submitted and approved by the COR prior to beginning work. The campus has a perimeter fence and gates but is freely open to the public. VA police are on site 24/7 and have responsibility for overall campus security however contractors are still responsible for securing their laydown yards and construction areas. Contractor vehicle placarding is required.
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. It is the contractor’s responsibility to ensure adequate time is allotted for this process and government is not responsible for delays. This process includes a federal background check, finger printing and a photo of the individual taken by the VA.
   a. Flash badges are the least restrictive and require a valid ID to obtain. Flash badge request take approximately three days to process. This badging requirement is the minimum for all employees working at the VA. This badge grants the contractor common physical access. Generally, for contractors working outside of the hospital. Flash badges are good for six months.
   b. Non-PIV Card requires two forms of ID and a special agreement check (SAC) background check which includes fingerprints. This takes approximately two weeks to process. This badge grants the contractor restricted physical access. This badge is for contractors working inside of the hospital. Non-PIV is good for one year.

c. PIV card requires NACI and SAC background investigations, fingerprints and training and two forms of ID. This takes approximately 30 days to process. This badge grants the contractor restricted physical access and allows access to more sensitive areas. This will allow access to secure areas such as IT closets. Only a limited number of these badges will be granted, and these will generally be reserved for supervisors only. PIV is good for one year.

2. General Contractor’s employees and subs may be subject to inspection of their personal effects when entering or leaving the project site.
3. 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. For working outside the scheduled shifts or days, the General Contractor shall give 3 days’ notice to the COR 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.
4. No photography of VA premises is allowed without written permission of the Contracting Officer.
5. VA reserves the right to 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. Guards: (NOT USED)

D. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the COR and security for the purpose of security inspections of every area of project including toolboxes and parked machines and take any emergency action.
2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation.
3. The construction entrance gate into the facility along Wellesley uses a Best blue core padlock. This gate is manually operated and must be secured every evening. Use of this gate may be revoked if the contractor cannot manage the security of it.

4. Construction areas will use a Best blue core lock wherever possible. Best blue keys can be purchased locally at AM Hardware and will not be provided by the VA.
5. If keys are required for spaces with existing locks the contractor will be required to check a key out from the VA's locksmith during normal operating hours. Any personnel in possession of a VA key will require a contractor PIV card as described in paragraph 1.5.B.1.c. If VA keys are lost or stolen the contractor will be held liable for rekeying any locks that were associated with any keys issued to them. The cost for rekeying these locks could be substantial.

E. Document Control:

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

b. “Sensitive information” including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

F. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any placard identified or labelled contractor vehicle entering the site and such request shall be submitted at least 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies. Extended periods of parking in limited access areas such as entrances, roadways, loading docks and etc. shall require prior approval coordinated by the COR.
2. Contractor designated parking area shall be described as the unpaved area beginning at the southwest corner of the campus and extending northward along the west fence line toward the new boiler plant and shall be the area between the west side of Lot D and the west fence (west of the drainage basin). The designated contractor parking area shall be shared by all identified contractor vehicles and shall not be dedicated to a sole contractor’s use. The designated contractor parking area shall NOT be maintained by the VA grounds service (to include but not be limited to: snow plowing, parking lines, mowing or etc.). All contractor vehicles must have a sign on the vehicle identifying the contractor, and a contact number for the driver on the dash. Contractors may not park in patient parking stalls or next to any building. Vehicles may park at the job site only if delivering materials or if the service vehicle is required for the work (i.e. welding rig, vac truck, etc.)
3. No General Contractor or Sub-Contractor privately owned vehicles (POVs) shall be allowed to park on the VA campus. All POVs shall be parked off campus or remotely at the contractor’s expense. All contractors shall be required to carpool their employees to the campus to greatest extent possible and to park the contractor identified vehicles in the designated contractor parking area only as described in F.2. above.
4. A limited number of 4 permits shall be issued for a General Contractor for parking in the designated contractor parking area only. Only contractor labelled vehicles shall be allowed to park on

campus in the designated contractor parking area or construction area as described in F2. above.

5. Traffic laws are in effect on the campus. VA police will issue tickets for all parking and moving violations (i.e. failure to wear seatbelts or failure to stop at stop signs). These are federal tickets and have fines associated with them.

1.6 OPERATIONS AND STORAGE AREAS

A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the COR. 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.
   1. Laydown / storage areas may be provided pending availability of space on a non-interference basis.
   2. Construction for large projects (i.e.: Minors (new construction), CSIs with new construction, large NRMs and pure infrastructure) may be allowed job trailer offices within the laydown areas onsite as determined by the COR and as indicated in the contract.
   3. Additional shared job trailer parking locations may be provided for multiple smaller scale projects during contract negotiation with the Contracting Officer in coordination with the COR as applicable.

B. Temporary buildings (e.g., storage sheds, shops, offices, Conex boxes, and job trailers) 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 at no cost to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its own expense upon completion of the work within 10 calendar days. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed. Any abandoned and not removed utilities shall be turned over to the VA secured in a safe, working condition. The VA Maintenance and Operations staff and the COR shall verify all new connections and disconnects from VA utilities.

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, sidewalks, irrigation systems, greenspace, or lawns, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, roads, irrigation systems, greenspace, or lawns. Contractor will contact local transit authority if work will impact public transportation.

D. Workers are subject to rules of MGVAMC applicable to their conduct.

E. Work Execution:

1. All work shall be executed to minimize impact to MGVAMC normal daily operations, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required. Construction that generates extended periods of outage which deteriorates or prevents the operational capacity of the facility shall be identified prior to any start of work and shall require COR coordination and approval.
   a. Store materials and equipment only in designated areas assigned by the COR.
   b. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two workdays. Provide unobstructed access to MGVAMC areas required to remain in operation.
   c. Where access by MGVAMC personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment may be permitted subject to fire and safety requirements.

F. Phasing:

1. The MGVAMC Emergency Room (UCC), Operating Rooms, Pharmacy, Laboratory, and Boiler Plant must maintain operations 24 hours a day 7 days a week. Therefore, any interruption in service to these areas of the hospital must be scheduled and coordinated with the COR to ensure that no lapses in operation occurs. 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:

a. To ensure such executions, Contractor shall furnish the COR with a schedule of 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 dates to insure accomplishment of this work in successive phases mutually agreeable to COR and Contractor. If the contractor falls more than ten calendar days behind schedule on a critical path activity, he shall submit a corrective plan of action to the Contracting Officer.

b. Work hours/shifts shall be at the contractor’s discretion with the exception of work which generates noise thru the building structure (i.e. jackhammering, roto-hammering, sledgehammer work, installation of powder driven fasteners, etc.) which shall be conducted between the hours of 4:30 PM and 9:00 PM Monday through Friday or during normal working hours on weekends. Work may be conducted at night and on weekends with prior approval of the COR. The work shifts outlined above will be subject to intermittent cessation of noise generating activities due to emergency surgeries, etc., which may occur at random times during the period. No additional contract costs will be entertained based upon this item of coordination for premium and/or overtime.

G. Construction Fence:

1. 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.

H. When a building and/or construction site is turned over to Contractor, Contractor shall accept entire responsibility including upkeep and maintenance of the building and/or construction site by:

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 coordinate to have a pre-inspection of site conducted by the 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.

I. Utilities Services:

1. Maintain existing utility services for the MGVAMC 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, data, and fiber), existing utility services shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by the COR.
   a. 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 the 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 MGVAMC Director’s prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS for additional requirements.
   b. Contractor shall submit a request to interrupt any such services to the COR, in writing, 10 calendar days in advance of proposed

interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.

c. 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 MGVAMC. Interruption times other than General Contractor's normal working hours may occur with COR approval.

d. 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.

e. 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.

f. 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.

J. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes, etc., and their hangers or supports, which are 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 with the exception of abandoned domestic water lines. 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. If shut-off valves are concealed from plain view, a sign will be placed in a visible location. When domestic water lines are abandoned, they shall comply with the VA legionella directive and design guidelines.

K. To minimize interference of construction activities with flow of MGVAMC 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.
2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.

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

M. The contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the contract. At completion of work, the contractor shall remove waste materials, rubbish, the contractor's tools, construction equipment, machinery and surplus material from and about the project.

N. Work hours of the project engineers are Monday through Friday between 0600 and 1630. If assistance is needed from project engineers, such as gaining access to spaces, it must be done during these hours unless coordinated and authorized by the COR prior to the start of any work.

O. Refer to contract documents for additional phasing information.

1.7 ALTERATIONS

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

1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of buildings.
2. Existing 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 employees.

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 the COR.

2. Items not reserved shall become property of the Contractor and be removed by Contractor from the MGVAMC.
3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

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.

(FAR 52.236-9)

1.10 RESTORATION

A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified,

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

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

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

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

1.11 LAYOUT OF WORK – NOT USED

1.12 AS-BUILT DRAWINGS

A. The contractor shall maintain one full size as-built drawing set on site, which shall be kept current during construction of the project, to include all contract changes, modifications and clarifications.

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

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

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

1.13 WARRANTY MANAGEMENT

A. Warranty Management Plan: Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction in at least 30 days before the planned pre-warranty conference, submit a 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 Bond: The Performance Bond must remain effective throughout the construction period

1. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.
2. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the contractor’s expenses, the Contracting Officer will have the right to recoup expenses from the bonding company.
3. Following oral or written notification of required construction warranty repair work, the Contractor shall respond within 3 business

days. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

C. NOT USED

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

1. Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and back charge the construction warranty payment item established.
   a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.
   b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.
   c. Third Priority Code 3. All other work to be initiated within 3 workdays and work continuously to completion or relief.
   d. The "Construction Warranty Service Priority List" is as follows:
      a. Code 1-Window Leaks
         i. Damage to property is occurring.
      b. Code 3
         i. All work not listed above.

1.14 USE OF ROADWAYS

A. For hauling, use only established public roads and roads on MGVAMC 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.

B. NOT USED

C. NOT USED

1.15 SITE INFORMATION

MCVAMC is a smoke free facility and no smoking is permitted on campus.

1.16 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.

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.

1.17 TEMPORARY USE OF EXISTING ELEVATORS

A. Use of existing elevator for handling building materials and Contractor's personnel will be permitted subject to following provisions:

1. Contractor makes all arrangements with the COR for use of elevators. The COR will ascertain that elevators are in proper condition. Contractor may use the service elevator for special nonrecurring time intervals when permission is granted. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.
2. Contractor covers and provides maximum protection of following elevator components:
   a. Entrance jambs, heads soffits and threshold plates.
   b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
   c. Finish flooring.

1.18 TEMPORARY USE OF NEW ELEVATORS (NOT USED)

1.19 TEMPORARY TOILETS

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

1.20 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 MGVAMC 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. Connecting to MGVAMC electrical distribution system: The Contractor shall obtain COR permission prior to connecting to MGVAMC 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. Connecting to the MGVAMC water distribution system: The Contractor shall obtain COR permission prior to connecting to MGVAMC water distribution system. The Contractor shall 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 CORs discretion) of use of water from MGVAMC'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 – NOT USED

1.22 TESTS

A. 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 (O&M) manuals (hard copies and electronic) and verbal instructions when required by the various sections of the specifications and as hereinafter specified.

B. Manuals:

1. O&M 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:

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

1.24 GOVERNMENT-FURNISHED EQUIPMENT – NOT USED

1.25 RELOCATED ITEMS

A. Contractor shall disconnect, dismantle as necessary, and remove all existing equipment and items as necessary to complete work.

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

C. Not Used

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

E. Contractor shall employ services of an installation engineer, who is an authorized representative of the manufacturer of this equipment to supervise assembly and installation of existing equipment, required to be relocated

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

1.26 STORAGE SPACE FOR DEPARTMENT OF VETERANS AFFAIRS EQUIPMENT - NOT USED

1.27 CONSTRUCTION SIGN

A. Provide a construction sign identifying the project per standard VA details available on the VA TIL website.

1.28 SAFETY SIGN

A. Provide a safety sign per standard VA details available on the VA TIL website.

1.29 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.

1.30 DIGITAL IMAGES - NOT USED

1.31 HISTORIC PRESERVATION - NOT USED

1.32 VA TRIRIGA CPMS - NOT USED

1.33 IDENTIFICATION

1. Verify identification requirements for all construction workers required by the MGVAMC. Refer to section 1.5.

1.34 EMERGENCY MANAGMENT

A. The contractor shall develop an emergency evacuation plan that will place the work site into a safe condition to allow for emergency personnel egress from the building. This action shall include and not be limited to removing all energy sources to work equipment and systems. The plan shall identify a primary and secondary evacuation routes. The routes shall lead personnel to a predetermined location to allow for personnel accountability. The contractor shall provide a personnel accountability report to the COR identifying number of personnel accounted for, and number of personnel missing.

B. The contractor shall acknowledge all emergency evacuation signals, such as fire alarms or strobes, whether audible, visual, or verbal, and comply with the contractor's emergency evacuation plan, or other instructions from any emergency respondent personnel at the scene.

C. The contractor shall check-in with MGVAMC PIV Registrar's Office to receive a facility emergency badge backer card for each contractor employee. This card shall be maintained on each person while on site at MGVAMC. This card contains emergency actions and emergency contact information, which will ensure personnel safety.

1.35 SCHEDULE AND FAILURE TO ACHIEVE PROGRESS

A. Contractor shall submit a complete CPM schedule for approval within sixty days of award. The CPM schedule is a working document and should be updated and refined at least weekly and shall be submitted monthly throughout the project. Any change in critical path or delay of more than ten working days shall be identified and a corrective action plan submitted as soon as the delay is identified. Detailed three-week look ahead schedules shall be submitted weekly and may be independent of the CPM schedule at the contractors discretion, however the data must be incorporated into the CPM. The CPM will indicate relationships, constraints, float, and dates for all activities and milestones at a minimum. Additional information shall be included at the COR's request. Submittal/shop drawing preparation time, review time, and procurement time shall be included for all critical path activities and items with long procurement times.

B. Should the progress fall behind the approved project schedule for reasons other than those that are excusable within the terms of the contract, the Contracting Officer may require provision of a written recovery plan for approval. The plan must detail how progress will be made-up to include which activities will be accelerated by adding additional crews, longer work hours, extra work days, etc.

C. Artificially Improving Progress:

1. Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for any logic, constraint, duration and calendar changes used in the creation of the recovery plan. Any additional resources, manpower,

or daily and weekly work hour changes proposed in the recovery plan must be evident at the work site and documented in the daily report along with the Schedule Narrative Report.

D. Failure to Perform:

1. Failure to perform work and maintain progress in accordance with the supplemental recovery plan may result in an interim and final unsatisfactory performance rating and may result in corrective action directed by the Contracting Officer pursuant to FAR 52.236-15 Schedules for Construction Contracts, FAR 52.249-10 Default (Fixed-Price Construction), and other contract provisions.

E. Recovery Schedule:

1. Should the Contracting Officer find it necessary, submit a recovery schedule pursuant to FAR 52.236-15 Schedules for Construction Contracts.

1.36 GREEN ENVIRONMENTAL MANAGEMENT SYSTEM (GEMS)

GEMS Awareness Training required for Contractors

All federal agencies are required by Executive Order to implement an Environmental Management System, reduce waste, reduce quantity of toxic and hazardous chemical and materials acquired, used or disposed of, increase diversion of solid waste by recycling, and use sustainable environmental practices (acquisition of bio-based, environmentally preferable, energy-efficient, water-efficient and recycled-content products).

The Department of Veterans Affairs has chosen the term GEMS to refer to the department’s Green Environmental Management System. Green Environmental Management Systems have been shown to be a valuable tool to lessen negative impacts on the environment, and create more efficient, cost effective means of providing service to our veterans. The GEMS program emphasizes importance of compliance to federal, state, and local regulations; encourages pollution prevention strategies whenever possible; and focuses on continued improvement on environmental issues. The GEMS Program is based on ISO 14001, which relates to Environmental Management Systems (EMS). The EMS provides a framework to review activities performed by, or on behalf of the organization, including work performed by contractors.

Any parties, including contractors, who perform an activity identified as being significant based on the impact on the environment, environmental compliance, exposure risk, etc., must be aware of our facility GEMS program and ways to reduce the environmental impacts. Training for contractors and

each member of their staff who is involved in significant activities should include operational controls used to reduce the environmental impacts.
The following construction activities have been identified as significant based on potential environmental impacts:

- Chemical Storage (potential for spills) Hazardous chemicals, if no alternative is available, must be stored in accordance with OSHA, EPA (49 CFR 265 Subpart I), and NFPA requirements. Any hazardous chemicals and wastes must be stored in a manner which would prevent release into the environment and must be disposed of in accordance with local, state and federal regulations. 40 CFR Parts 262-268. See list below of construction waste that is potentially hazardous waste.
- Asbestos Abatement activities 29 CFR 1926.1101
- Activities involving lead, i.e. lead based paint 29 CFR 1926.62
- Recyclable material. All contractors should recycle as much material as possible. The records of materials recycled must be submitted to the COR for recordkeeping.
- Activities which may result in contaminates (oils, fuel, chemicals, debris) flowing down the storm sewer or on ground surface. 40 CFR 112
- Activities which involve handling of universal wastes (batteries, fluorescent lamps, mercury containing devices-switches, pesticides). 40 CFR Part 273

- Work on refrigerator, air conditioners, other chiller units or other sources of ozone depleting substances. 40 CFR Section 82

Requirement to Maintain Record of Materials Reused or Recycled

In accordance with the **Federal Pollution Prevention Act** (source reduction, recycling, treatment and environmentally safe disposal to the environment), **Resource Conservation and Recovery Act** (cradle to grave management of hazardous waste and Federal procurement of recycled products) and **Federal Facilities Compliance Act** (subjects Federal facilities to Federal, State and local waste management and disposal laws and regulations) contractors and project managers are required to monitor waste(s) taken from a project, and certify proper disposal. If recycle or reuse of a waste product (doors, light fixtures, etc.) is possible, reasonable effort should be made to reuse or recycle the product.

Items that are reused or recycled should be logged on the attached Materials Reused/Recycled Record by the Project Manager. At the conclusion of the project, this form shall be reviewed and signed by the COR, with a copy given to the M&O Foreman and the GEMS Coordinator for their records.

Materials Reused or Recycled Record

Project Number:_____	**Project Location:_____**		**Page ____ of ____**	
Date:_____			**Project Manager:_____**	
Material being reused/recycled	**Reused/Recycled**	**Quantity**	**Location Taken**	**Comments**
Example: (Plumbing Fixtures)	Reused	3	Plumbing Shop	Delivered on _____

Cc: COR
Maintenance & Operations
GEMS Program Manager

- - - E N D - -

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 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 COR 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 COR; 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 COR, 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 COR'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 COR. The contractor shall make a separate written detailed request to the COR identifying these date constraints and secure the COR's written approval before incorporating them into the network diagram. The COR'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 COR, 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 COR. The revised submission will be reviewed by the COR 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 _____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 COR 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 for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION).

C. In accordance with FAR 52.236 – 1 (PERFORMANCE OF WORK BY THE CONTRACTOR), the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work.

D. The Contractor shall cost load work activities/events for all BID ITEMS 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. COR'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 COR 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 for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project schedule changes and

associated data; and 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 COR 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 COR for approval.

C. COR'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 COR 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 COR'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 COR will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the COR's decision.

C. The Contractor shall submit each request for a change in the contract completion date to the COR 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.

- - - E N D - - -

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 COR may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the government.

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

1.2 DEFINITIONS

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

B. Shop Drawings: Drawings, diagrams, 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 COR.

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:

CONTRACTOR
(Firm Name)
_____Approved
_____Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

1.6 SUBMITTAL FORMAT AND TRANSMISSION

A. Provide submittals in electronic format, with the exception of material samples. Use PDF as the electronic format, unless otherwise specified or directed by the COR.

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

C. Electronic files must be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied. 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 COR.

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

1.7 SAMPLES

A. Submit two sets of physical samples showing 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 COR may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.9 TEST REPORTS

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.

- - - E N D - - -

SECTION 01 35 26
SAFETY REQUIREMENTS
TABLE OF CONTENTS

1.1 APPLICABLE PUBLICATIONS: 1
1.2 DEFINITIONS: 2
1.3 SUBMITTAL REQUIRMENTS: 6
1.4 REGULATORY REQUIREMENTS: 7
1.5 ACCIDENT PREVENTION PLAN (APP): 7
1.6 ACTIVITY HAZARD ANALYSES (AHAs): 11
1.7 PRECONSTRUCTION SAFETY CONFERENCE: 13
1.8 SAFETY MEETINGS: 13
1.9 "SITE SAFETY AND HEALTH OFFICER" (SSHO) and "COMPETENT PERSON" (CP): 14
1.10 TRAINING: 15
1.11 INSPECTIONS: 16
1.12 MISHAPS, OSHA 300 LOGS, AND MAN-HOURS: 17
1.13 PERSONAL PROTECTIVE EQUIPMENT (PPE): 18
1.14 PRE-CONSTRUCTION RISK ASSESSMENT 19
1.15 DUST CONTROL 20
1.16 TUBERCULOSIS SCREENING 21
1.17 FIRE SAFETY 21
1.18 ELECTRICAL 24
1.19 FALL PROTECTION 25
1.20 SCAFFOLDS AND OTHER WORK PLATFORMS 26
1.21 EXCAVATION AND TRENCHES 26
1.22 CRANES 29
1.23 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT) 30
1.24 CONFINED SPACE ENTRY 30
1.25 WELDING AND CUTTING 30
1.26 LADDERS 30
1.27 FLOOR & WALL OPENINGS 31

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 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, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
   b. BACKGROUND INFORMATION. List the following:
      1) Contractor;
      2) Contract number;
      3) Project name;
      4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).
   c. STATEMENT OF SAFETY AND HEALTH POLICY. Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor’s written safety program goals, objectives, and accident experience goals for this contract should be provided. The Statement of Safety and Health Policy must be signed by a company executive.
   d. RESPONSIBILITIES AND LINES OF AUTHORITIES. Provide the following:
      1) A statement of the employer’s ultimate responsibility for the implementation of his SOH program;
      2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.

3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA or EM 385-1-1 Competent/Qualified Person(s) requirements must be attached.;
4) Requirements that no work shall be performed unless a designated competent person is present on the job site;
5) Requirements for pre-task Activity Hazard Analysis (AHAs);
6) Lines of authority;
7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

e. SUBCONTRACTORS AND SUPPLIERS. If applicable, provide procedures for coordinating SOH activities with other employers on the job site:
1) Identification of subcontractors and suppliers (if known);
2) Safety responsibilities of subcontractors and suppliers.

f. TRAINING.
1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc.…) and any requirements for periodic retraining/recertification are required.
3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
4) OSHA 10-hour Construction Outreach training within the past five years is required for all workers on site and the OSHA 30-hour Construction Outreach training within the past five years is required for Trade Competent Persons (CPs)

g. SAFETY AND HEALTH INSPECTIONS.
1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., “Site Safety and Health CP”), proof of inspector’s training/qualifications, when

inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.

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

h. MISHAP INVESTIGATION & REPORTING.

1) The APP shall include identify person(s) responsible to provide the following to the 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 COR 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 COR, 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. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Resident Engineering Office and COR 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 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 COR 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 COR 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 COR 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 COR on

request. Notify the COR 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 COR 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 COR.

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 COR 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 COR 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 COR 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 COR 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 COR within 7 calendar days of the accident. The COR 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 COR 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 COR monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the COR 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 COR 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 COR 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 COR 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 COR 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 COR 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 Two-hour fire-rated solid core wood in steel frame, painted
3. Dust proof two-hour fire-rated drywall
4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer’s instructions.
5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches
7. Disinfectant: EPA-registered, Hospital-approved disinfectant or equivalent product
8. Portable Ceiling Access Module

1.15 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 TUBERCULOSIS SCREENING

A. Contractor shall provide written certification that all contract employees assigned to the work site have had a pre-placement tuberculin screening within 90 days prior to assignment to the worksite and been found have negative TB screening reactions. Contractors shall be required to show documentation of negative TB screening reactions for any additional workers who are added after the 90-day requirement before they will be allowed to work on the work site. NOTE: This can be the Center for Disease Control (CDC) and Prevention and two-step skin testing or a Food and Drug Administration (FDA)-approved blood test.

1. Contract employees manifesting positive screening reactions to the tuberculin shall be examined according to current CDC guidelines prior to working on VHA property.
2. Subsequently, if the employee is found without evidence of active (infectious) pulmonary TB, a statement documenting examination by a physician shall be on file with the employer (construction contractor), noting that the employee with a positive tuberculin screening test is without evidence of active (infectious) pulmonary TB.
3. If the employee is found with evidence of active (infectious) pulmonary TB, the employee shall require treatment with a subsequent statement to the fact on file with the employer before being allowed to return to work on VHA property.

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

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

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

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

E. Temporary Construction Partitions:

1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or fire-retardant treated plywood (fire-retardant treated in accordance with NFPA 703) on both sides of fire-retardant treated wood framing or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
2. Install two-hour fire-rated temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.

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

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

H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR.

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

J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

K. 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.

L. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.

M. 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 COR. 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.

N. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR.

O. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR. Obtain permits from COR at least 72 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

P. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COR.

Q. 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.

R. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

S. 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.

1.18 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 COR 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 COR.

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 COR 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).

1.19 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.

1.20 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.

1.21 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.

1.22 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 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 COR 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.

1.23 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.

1.24 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.

1.25 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. Obtain permits from COR at least 72 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

1.26 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.

1.27 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.

- - - E N D - - -

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

- - - E N D - - -

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 COR 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 COR.

3.2 CQC PLAN

A. Submit the CQC Plan no later than CO or Designee to determine during Constructability review – 15 days after receipt of Notice to Proceed (NTP) proposed to implement the requirements of the FAR Clause 52.246.12 titled "Inspection of Construction". The Government will consider an Interim CQC Plan for the first days of operation, which must be accepted within 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 be issued by the CQC System Manager. Furnish copies of these letters to the COR.
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 COR 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.

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 COR, 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 COR 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 COR 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 COR 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 COR. 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 15 years construction experience on construction similar to the scope of this Contract. This CQC System manager is on the site at all times during construction and is employed by the General Contractor. The CQC System Manger is assigned as CQC System Manager but has duties as project superintendent in addition to quality control. Identify in the plan an alternate to serve in the event of the CDQC System Manager’s absence. The requirements for the alternate are the same as the CQC System Manager.

C. CQC Personnel: In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist in the CQC System Manager for the following areas, as applicable: electrical, mechanical, civil, structural, environmental, architectural, materials technician submittals clerk, Commissioning Agent/LEED specialist, and low voltage systems. These individuals or specified technical companies are directly employed by the General Contractor and cannot be employed by a supplier or subcontractor on this project or 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.

Area	Qualifications
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 COR 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 COR 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. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.
f. 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.
g. Review of the appropriate Activity Hazard Analysis (AHA) to assure safety requirements are met.
h. 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.
i. Check to ensure that the portion of the plan for the work to be performed has been accepted by the COR.
j. Discussion of the initial control phase.
k. 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.

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.

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 COR 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 COR. 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. 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 COR 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 COR based upon results of the Pre-Final Inspection. Notify the COR 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 COR 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 COR 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 COR 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.

- - - E N D - - -

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 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. Environmental Monitoring Plans for the job site including land, water, air, and noise.

j. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.

k. Inclusion of “best management practices” and methodologies.

B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.5 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 50 (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.

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. 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 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 Washington and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.

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

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

1. Perform construction activities involving repetitive, high-level impact noise only between 8:00a.m. and 6:00p.m unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:

a. Maintain maximum permissible construction equipment noise levels at 15 meter (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	NA
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.

- - - E N D - - -

SECTION 01 58 16
TEMPORARY INTERIOR SIGNAGE

PART 1 GENERAL

1.1 DESCRIPTION

This section specifies temporary interior signs.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNS

A. Fabricate from 50 Kg (110 pound) mat finish white paper.

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

C. Punch 3 mm (1/8-inch) diameter hole centered on 100 mm (4-inch) dimension of tag. Edge of Hole spaced approximately 13 mm (1/2-inch) from one end on tag.

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

E. Ties: Steel wire 0.3 mm (0.0120-inch) thick, attach to tag with twist tie, leaving 150 mm (6-inch) long free ends.

PART 3 EXECUTION

3.1 INSTALLATION

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

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

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

3.2 LOCATION

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

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

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

C. Replace missing, damaged, or illegible signs.

- - - E N D - - -

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.

1.3 QUALITY ASSURANCE

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

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

C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.

D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations.

F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.

H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.

B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.

C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.

D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.

E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).

F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.

G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.

H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.

I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in

the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.

M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.

O. Return: To give back reusable items or unused products to vendors for credit.

P. Salvage: To remove waste materials from the site for resale or re-use by a third party.

Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.

R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.

S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:

B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:

1. Procedures to be used for debris management.
2. Techniques to be used to minimize waste generation.

3. Analysis of the estimated job site waste to be generated:
   a. List of each material and quantity to be salvaged, reused, recycled.
   b. List of each material and quantity proposed to be taken to a landfill.
4. Detailed description of the Means/Methods to be used for material handling.
   a. On site: Material separation, storage, protection where applicable.
   b. Off site: Transportation means and destination. Include list of materials.
      1) Description of materials to be site-separated and self-hauled to designated facilities.
      2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
         a) The names and locations of mixed debris reuse and recycling facilities or sites.
         b) The names and locations of trash disposal landfill facilities or sites.
         c) Documentation that the facilities or sites are approved to receive the materials.

C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.
E. Target waste diversion rate by material and an overall diversion rate.
F. Final report documenting the results of implementation of the preconstruction waste management plan.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.

B. U.S. Green Building Council (USGBC): LEED Green Building Rating System for New Construction

1. 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. Records shall be kept in accordance with the LEED Reference Guide and LEED Template and/or Green Globes for New Construction 2019 Technical Reference Manual.

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, and 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.

C. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

1.3 DEFINITIONS

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

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

B. Biobased Products: Biobased products are derived from plants and other renewable agricultural, marine, and forestry materials and provide an alternative to conventional petroleum derived products. Biobased

products include diverse categories such as lubricants, cleaning products, inks, fertilizers, and bioplastics.

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

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

1.4 REFERENCE STANDARDS

A. Carpet and Rug Institute Green Label Plus program.

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

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

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

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

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

G. Green Electronic Council EPEAT Program (EPEAT).

1.5 SUBMITTALS

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

B. Sustainability Action Plan:

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

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

D. Construction Indoor Air Quality (IAQ) Management Plan:
   1. Not more than 30 days after Preconstruction Meeting provide a Construction IAQ Management Plan as an electronic file including descriptions of the following:
      a. Instruction procedures for meeting or exceeding minimum requirements of ANSI/SMACNA 008-2008, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling.
      b. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage.
      c. Schedule of submission of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials.
      d. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille.
      e. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit.
      f. Instruction procedures and schedule for implementing building flush-out.

E. Product Submittals:
   1. Recycled Content: Submit product data from manufacturer indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content (excluding MEP systems equipment and components).
   2. Biobased Content: Submit product data for products to be installed or used which are included in any of the USDA BioPreferred program’s product categories. Data to include percentage of biobased content and source of biobased material.
   3. Low Pollutant-Emitting Materials: Submit product data confirming compliance with relevant requirements for all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.

4. For applicable products and equipment, submit product documentation confirming ENERGY STAR label, FEMP certification, WaterSense, and/or EPEAT certification.

F. Sustainable Construction Progress Reports: Concurrent with each Application for Payment, submit a Sustainable Construction Progress Report to confirm adherence with Sustainability Action Plan.
1. Include narratives of revised strategies for bringing work progress into compliance with plan and product submittal data.
2. Include updated and current Low Pollutant-Emitting Materials Tracking Spreadsheet.
3. Include construction waste tracking, in tons or cubic yards, including waste description, whether diverted or landfilled, hauler, and percent diverted for comingled quantities; and excluding land-clearing debris and soil. Provide haul receipts and documentation of diverted percentages for comingled wastes.

G. Closeout Submittals: Within 14 days after Substantial Completion provide the following:
1. Final version of Low Pollutant-Emitting Materials Tracking Spreadsheet.
2. Manufacturer’s cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed air handling units are used during construction.
3. Manufacturer’s cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for final filtration media in air handling units.
4. Minimum 18 construction photographs including six photographs taken on three different occasions during construction of ANSI/SMACNA 008-2008, Chapter 3 approaches employed, along with a brief description of each approach, documenting implementation of IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
5. Flush-out Documentation:
   a. Product data for filtration media used during flush-out.
   b. Product data for filtration media installed immediately prior to occupancy.

c. Signed statement describing building air flush-out procedures including dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.

1.6 QUALITY ASSURANCE

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

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

1.7 APPLICABLE PUBLICATIONS

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

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

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

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

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

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

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

H. California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, Emission Testing

method for California Specification 01350 (CDPH Standard Method V1.1-2010).

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

J. ASHRAE Standard 52.2-2007.

PART 2 – PRODUCTS

2.1 PERFORMANCE CRITERIA

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

B. Low Pollutant-Emitting Materials:

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

a. Flooring Adhesives and Sealants:

1) Indoor carpet adhesives: 50 g/L.

2) Wood Flooring Adhesive: 100 g/L.

3) Rubber Floor Adhesives: 60 g/L.

4) Subfloor Adhesives: 50 g/L.

5) Ceramic Tile Adhesives and Grout: 65 g/L.

6) Cove Base Adhesives: 50 g/L.

7) Multipurpose Construction Adhesives: 70 g/L.

8) Porous Material (Except Wood) Substrate: 50 g/L.

9) Wood Substrate: 30 g/L.

10) Architectural Non-Porous Sealant Primer: 250 g/L.

11) Architectural Porous Sealant Primer: 775 g/L.

12) Other Sealant Primer: 750 g/L.

13) Structural Wood Member Adhesive: 140 g/L.

14) Sheet-Applied Rubber Lining Operations: 850 g/L.

15) Top and Trim Adhesive: 250 g/L.

16) Architectural Sealant: 250 g/L.

17) Other Sealant: 420 g/L.

b. Non-Flooring Adhesives and Sealants:

1) Drywall and Panel Adhesives: 50 g/L.

2) Multipurpose Construction Adhesives: 70 g/L.

3) Structural Glazing Adhesives: 100 g/L.

4) Metal-to-Metal Substrate Adhesives: 30 g/L.

5) Plastic Foam Substrate Adhesive: 50 g/L.
6) Porous Material (Except Wood) Substrate Adhesive: 50 g/L.
7) Wood Substrate Adhesive: 30 g/L.
8) Fiberglass Substrate Adhesive: 80 g/L.
9) Architectural Non-Porous Sealant Primer: 250 g/L.
10) Architectural Porous Sealant Primer: 775 g/L.
11) Other Sealant Primer: 750 g/L.
12) PVC Welding Adhesives: 510 g/L.
13) CPVC Welding Adhesives: 490 g/L.
14) ABS Welding Adhesives: 325 g/L.
15) Plastic Cement Welding Adhesives: 250 g/L.
16) Adhesive Primer for Plastic: 550 g/L.
17) Contact Adhesive: 80 g/L.
18) Special Purpose Contact Adhesive: 250 g/L.
19) Structural Wood Member Adhesive: 140 g/L.
20) Sheet Applied Rubber Lining Operations: 850 g/L.
21) Top and Trim Adhesive: 250 g/L.
22) Architectural Sealants: 250 g/L.
23) Other Sealants: 420 g/L.

2. Aerosol adhesives applied on site within the weatherproofing membrane must comply with the following Green Seal GS-36.
   a. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent VOCs by weight.
   b. Aerosol Adhesive, General-Purpose Web Spray: 55 percent VOCs by weight.
   c. Special-Purpose Aerosol Adhesive (All Types): 70 percent VOCs by weight.
3. Paints and coatings applied on site within the weatherproofing membrane must comply with the following criteria:
   a. VOC content limits for paints and coatings established in Green Seal Standard GS-11.
   b. VOC content limit for anti-corrosive and anti-rust paints applied to interior ferrous metal substrates of 250 g/L established in Green Seal GC-03.
   c. Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements must not exceed VOC content limits established in SCAQMD Rule 1113.

d. Comply with the following VOC content limits:
   1) Anti-Corrosive/Antirust Paints: 250 g/L.
   2) Clear Wood Finish, Lacquer: 550 g/L.
   3) Clear Wood Finish, Sanding Sealer: 350 g/L.
   4) Clear Wood Finish, Varnish: 350 g/L.
   5) Floor Coating: 100 g/L.
   6) Interior Flat Paint, Coating or Primer: 50 g/L.
   7) Interior Non-Flat Paint, Coating or Primer: 150 g/L.
   8) Sealers and Undercoaters: 200 g/L.
   9) Shellac, Clear: 730 g/L.
   10) Shellac, Pigmented: 550 g/L.
   11) Stain: 250 g/L.
   12) Clear Brushing Lacquer: 680 g/L.
   13) Concrete Curing Compounds: 350 g/L.
   14) Japans/Faux Finishing Coatings: 350 g/L.
   15) Magnesite Cement Coatings: 450 g/L.
   16) Pigmented Lacquer: 550 g/L.
   17) Waterproofing Sealers: 250 g/L.
   18) Wood Preservatives: 350 g/L.
   19) Low-Solids Coatings: 120 g/L.

4. Carpet installed in building interior must comply with one of the following:
   a. Meet testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
   b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at the 14 day time point.
5. Each non-carpet flooring element installed in building interior which is not inherently non-emitting (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) must comply with one of the following:
   a. Meet requirements of the FloorScore standard as shown with testing by an independent third-party.
   b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at 14 day time point.

6. Composite wood and agrifiber products used within the weatherproofing membrane must contain no added urea-formaldehyde resins.
7. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde.

C. Recycled Content:

1. Any products being installed or used that are listed on EPA Comprehensive Procurement Guidelines designated product list must meet or exceed the EPA's recycled content recommendations. The EPA Comprehensive Procurement Guidelines categories include:
   a. Building insulation.
   b. Cement and concrete.
   c. Consolidated and reprocessed latex paint.
   d. Floor tiles.
   e. Flowable fill.
   f. Laminated paperboard.
   g. Modular threshold ramps.
   h. Nonpressure pipe.
   i. Patio blocks.
   j. Railroad grade crossing surfaces.
   k. Roofing materials.
   l. Shower and restroom dividers/partitions.
   m. Structural fiberboard.
   n. Nylon carpet and nylon carpet backing.
   o. Compost and fertilizer made from recovered organic materials.
   p. Hydraulic mulch.
   q. Lawn and garden edging.
   r. Plastic lumber landscaping timbers and posts.
   s. Park benches and picnic tables.
   t. Plastic fencing.
   u. Playground equipment.
   v. Playground surfaces.
   w. Bike racks.

D. Biobased Content:

1. Materials and equipment being installed or used that are listed on the USDA BioPreferred program product category list must meet or

exceed USDA's minimum biobased content threshold. Refer to individual specification sections for detailed requirements applicable to that section.

a. USDA BioPreferred program categories include:

1) Adhesive and Mastic Removers.
2) Carpets.
3) Cleaners.
4) Composite Panels.
5) Corrosion Preventatives.
6) Erosion Control Materials.
7) Dust Suppressants.
8) Fertilizers.
9) Floor Cleaners and Protectors.
10) Floor Coverings (Non-Carpet).
11) Glass Cleaners.
12) Hydraulic Fluids.
13) Industrial Cleaners.
14) Interior Paints and Coatings.
15) Mulch and Compost Materials.
16) Multipurpose Cleaners.
17) Multipurpose Lubricants.
18) Packaging Films.
19) Paint Removers.
20) Plastic Insulating Foam.
21) Pneumatic Equipment Lubricants.
22) Roof Coatings.
23) Wastewater Systems Coatings.
24) Water Tank Coatings.
25) Wood and Concrete Sealers.
26) Wood and Concrete Stains.

E. Materials, products, and equipment being installed which fall into a category covered by the WaterSense program must be WaterSense-labeled or meet or exceed WaterSense program performance requirements, unless disallowed for infection control reasons.

1. WaterSense categories include:

a. Bathroom Faucets
b. Commercial Toilets

c. Irrigation Controllers

d. Pre-Rinse Spray Valves

e. Residential Toilets

f. Showerheads

g. Spray Sprinkler Bodies

h. Urinals

F. Materials, products, and equipment being installed which fall into any of the following product categories must be Energy Star-labeled.

1. Applicable Energy Star product categories as of 09/14/2017 include:

a. Appliances:

1) Air Purifiers and Cleaners.

2) Clothes Dryers (Residential).

3) Clothes Washers (Commercial & Residential).

4) Dehumidifiers.

5) Dishwashers (Residential).

6) Freezers (Residential).

7) Refrigerators (Residential).

b. Electronics and Information Technology:

1) Audio/Video Equipment.

2) Computers.

3) Data Center Storage.

4) Digital Media Player.

5) Enterprise Servers.

6) Imaging Equipment.

7) Monitors.

8) Professional Displays.

9) Set-Top and Cable Boxes.

10) Telephones.

11) Televisions.

12) Uninterruptible Power Supplies.

13) Voice over Internet Protocol (VoIP) Phones.

c. Food Service Equipment (Commercial):

1) Dishwashers.

2) Fryers.

3) Griddles.

4) Hot Food Holding Cabinets.

5) Ice Makers.

6) Ovens.
7) Refrigerators and Freezers.
8) Steam Cookers.
9) Vending Machines.

d. Heating and Cooling Equipment:
1) Air-Source Heat Pumps (Residential).
2) Boilers.
3) Ceiling Fans (Residential).
4) Central Air Conditioners (Residential).
5) Ductless Heating and Cooling (Residential).
6) Furnaces (Residential).
7) Water Heaters.
8) Geothermal Heat Pumps (Residential).
9) Light Commercial Heating and Cooling Equipment.
10) Room Air Conditioners (Residential).
11) Ventilation Fans (Residential).

e. Other:
1) Decorative Light Strings.
2) Electric Vehicle Supply Equipment.
3) Laboratory-Grade Refrigerators and Freezers.
4) Light Bulbs.
5) Light Fixtures.
6) Pool Pumps.
7) Roof Products.
8) Water Coolers.
9) Windows, Doors, and Skylights.

G. Materials, products, and equipment being installed which fall into any of the following categories must be FEMP-designated. FEMP-designated product categories as of 09/14/2017 include:
1. Boilers (Commercial).
2. Dishwashers (Commercial).
3. Electric Chillers, Air-Cooled (Commercial).
4. Electric Chillers, Water-Cooled (Commercial).
5. Exterior Lighting.
6. Fluorescent Ballasts.
7. Fluorescent Lamps, General Service.
8. Ice Machines, Water-Cooled.

9. Industrial Lighting (High/Low Bay).
10. Light Emitting Diode (LED) Luminaires.

H. Electronic products and equipment being installed which fall into any of the following categories shall be EPEAT registered. Electronic products and equipment covered by EPEAT program as of 09/14/2017 include:
1. Computers.
2. Displays.
3. Imaging Equipment.
4. Televisions.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Construction Indoor Air Quality Management:
1. During construction, meet or exceed recommended control measures of ANSI/SMACNA 008-2008, Chapter 3.
2. Protect stored on-site and installed absorptive materials from moisture damage.
3. If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda). Replace all filtration media immediately prior to occupancy.
4. Perform building flush-out as follows:
a. After construction ends, prior to occupancy and with interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 degrees Fahrenheit and a relative humidity no higher than 60 percent.
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.

- - - E N D - - -

SECTION 01 91 00
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL
1.1 COMMISSIONING DESCRIPTION

A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.

B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 7, Division 22, Division 26, and Division 27 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.

C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.

D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 7, Division 22, Division 26, and Division 27 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.

E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA’s operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction and post-occupancy

phases is intended to achieve the following specific objectives according to the contract documents:

1. Verify that the applicable equipment and systems are installed in accordance with the contact documents and according to the manufacturer's recommendations.
2. Verify and document proper integrated performance of equipment and systems.
3. Verify that Operations & Maintenance documentation is complete.
4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
5. Verify that the VA’s operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
6. Document the successful achievement of the commissioning objectives listed above.

F. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.

1.2 CONTRACTUAL RELATIONSHIPS

A. For this construction project, the Department of Veterans Affairs contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the COR as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer.

B. In this project, only two contract parties are recognized and communications on contractual issues are strictly limited to VA COR and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the COR and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the COR.

C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to the construction process. By its nature, a high level of communication

and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc.) is essential to the success of the Commissioning effort.

D. With these fundamental practices in mind, the commissioning process described herein has been developed to recognize that, in the execution of the Commissioning Process, the Commissioning Agent must develop effective methods to communicate with every member of the construction team involved in delivering commissioned systems while simultaneously respecting the exclusive contract authority of the Contracting Officer and COR. Thus, the procedures outlined in this specification must be executed within the following limitations:

1. No communications (verbal or written) from the Commissioning Agent shall be deemed to constitute direction that modifies the terms of any contract between the Department of Veterans Affairs and the Contractor.
2. Commissioning Issues identified by the Commissioning Agent will be delivered to the COR and copied to the designated Commissioning Representatives for the Contractor and subcontractors on the Commissioning Team for information only in order to expedite the communication process. These issues must be understood as the professional opinion of the Commissioning Agent and as suggestions for resolution.
3. In the event that any Commissioning Issues and suggested resolutions are deemed by the COR to require either an official interpretation of the construction documents or require a modification of the contract documents, the COR will issue an official directive to this effect.
4. All parties to the Commissioning Process shall be individually responsible for alerting the COR of any issues that they deem to constitute a potential contract change prior to acting on these issues.
5. Authority for resolution or modification of design and construction issues rests solely with the COR, with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

1.3 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 32.16.15 PROJECT SCHEDULES (SMALL PROJECTS – DESIGN/BID/BUILD)
C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
D. Section 01 81 13 SUSTAINABLE CONSTRUCTION REQUIREMENTS
E. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.
F. Section 27 08 00 COMMISSIONING OF COMMUNICATIONS SYSTEMS.

1.4 SUMMARY

A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.
C. The commissioning activities have been developed to support the United States Green Building Council's (USGBC) LEED ™ rating program and to support delivery of project performance in accordance with the VA requirements developed for the project to support the following credits:
   1. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" and the prerequisite of "Fundamental Building Systems Commissioning."
   2. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" requirements for the "Enhanced Building System Commissioning" credit.
   3. Activities and documentation for the LEED™ section on "Measurement and Verification" requirements for the Measurement and Verification credit.
D. The commissioning activities have been developed to support the Green Buildings Initiative's Green Globes rating program and to support delivery of project performance in accordance with the VA requirements developed for the project.

1.5 ACRONYMS

List of Acronyms	
Acronym	Meaning
A/E	Architect / Engineer Design Team
AHJ	Authority Having Jurisdiction

List of Acronyms	
Acronym	Meaning
ASHRAE	Association Society for Heating Air Condition and Refrigeration Engineers
BOD	Basis of Design
BSC	Building Systems Commissioning
CCTV	Closed Circuit Television
CD	Construction Documents
CMMS	Computerized Maintenance Management System
CO	Contracting Officer (VA)
COR	Contracting Officer's Representative
COBie	Construction Operations Building Information Exchange
CPC	Construction Phase Commissioning
Cx	Commissioning
CxA	Commissioning Agent
CxM	Commissioning Manager
CxR	Commissioning Representative
DPC	Design Phase Commissioning
FPT	Functional Performance Test
GBI-GG	Green Building Initiative - Green Globes
HVAC	Heating, Ventilation, and Air Conditioning
LEED	Leadership in Energy and Environmental Design
NC	Department of Veterans Affairs National Cemetery
NCA	Department of Veterans Affairs National Cemetery Administration
NEBB	National Environmental Balancing Bureau
O&M	Operations & Maintenance
OPR	Owner's Project Requirements
PFC	Pre-Functional Checklist
PFT	Pre-Functional Test
SD	Schematic Design
SO	Site Observation
TAB	Test Adjust and Balance
VA	Department of Veterans Affairs
VAMC	VA Medical Center
VA CFM	VA Office of Construction and Facilities Management

List of Acronyms	
Acronym	Meaning
VACO	VA Central Office
VA PM	VA Project Manager
USGBC	United States Green Building Council

1.6 DEFINITIONS

Acceptance Phase Commissioning: Commissioning tasks executed after most construction has been completed, most Site Observations and Static Tests have been completed and Pre-Functional Testing has been completed and accepted. The main commissioning activities performed during this phase are verification that the installed systems are functional by conducting Systems Functional Performance tests and Owner Training.

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

Back Check: A back check is a verification that an agreed upon solution to a design comment has been adequately addressed in a subsequent design review

Basis of Design (BOD): The Engineer’s Basis of Design is comprised of two components: the Design Criteria and the Design Narrative, these documents record the concepts, calculations, decisions, and product selections used to meet the Owner’s Project Requirements (OPR) and to satisfy applicable regulatory requirements, standards, and guidelines.

Benchmarks: Benchmarks are the comparison of a building’s energy usage to other similar buildings and to the building itself.. For example, ENERGY STAR Portfolio Manager is a frequently used and nationally recognized building energy benchmarking tool.

Building Information Modeling (BIM): Building Information Modeling is a parametric database which allows a building to be designed and constructed virtually in 3D, and provides reports both in 2D views and as schedules. This electronic information can be extracted and reused for pre-populating facility management CMMS systems. Building Systems Commissioning (BSC): NEBB acronym used to designate its commissioning program.

Calibrate: The act of comparing an instrument of unknown accuracy with a standard of known accuracy to detect, correlate, report, or eliminate by adjustment any variation in the accuracy of the tested instrument.

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

COBie: Construction Operations Building Information Exchange (COBie) is an electronic industry data format used to transfer information developed during design, construction, and commissioning into the Computer Maintenance Management Systems (CMMS) used to operate facilities. See the Whole Building Design Guide website for further information (http://www.wbdg.org/resources/cobie.php)

Commissionability: Defines a design component or construction process that has the necessary elements that will allow a system or component to be effectively measured, tested, operated and commissioned

Commissioning Agent (CxA): The qualified Commissioning Professional who administers the Cx process by managing the Cx team and overseeing the Commissioning Process. Where CxA is used in this specification it means the Commissioning Agent, members of his staff or appointed members of the commissioning team. Note that LEED uses the term Commissioning Authority in lieu of Commissioning Agent.

Commissioning Checklists: Lists of data or inspections to be verified to ensure proper system or component installation, operation, and function. Verification checklists are developed and used during all phases of the commissioning process to verify that the Owner's Project Requirements (OPR) is being achieved.

Commissioning Design Review: The commissioning design review is a collaborative review of the design professionals design documents for items pertaining to the following: owner's project requirements; basis of design; operability and maintainability (O&M) including documentation; functionality; training; energy efficiency, control systems' sequence of operations including building automation system features; commissioning specifications and the ability to functionally test the systems.

Commissioning Issue: A condition identified by the Commissioning Agent or other member of the Commissioning Team that adversely affects the commissionability, operability, maintainability, or functionality of a system, equipment, or component. A condition that is in conflict with the Contract Documents and/or performance requirements of the installed systems and components. (See also – Commissioning Observation).

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

Commissioning Observation: An issue identified by the Commissioning Agent or other member of the Commissioning Team that does not conform to the project OPR, contract documents or standard industry best practices. (See also Commissioning Issue)

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

Commissioning Process: A quality focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems, components, and assemblies are planned, designed, installed, tested, can be operated, and maintained to meet the Owner's Project Requirements.

Commissioning Report: The final commissioning document which presents the commissioning process results for the project. Cx reports include an executive summary, the commissioning plan, issue log, correspondence, and all appropriate check sheets and test forms.

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

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

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

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

Contract Documents (CD): Contract documents include design and construction contracts, price agreements and procedure agreements. Contract Documents also include all final and complete drawings, specifications and all applicable contract modifications or supplements.

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

Coordination Drawings: Drawings showing the work of all trades that are used to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances. On mechanical projects, coordination drawings include structural steel, ductwork, major piping and electrical conduit and show the elevations and locations of the above components.

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

Deferred System Test: Tests that cannot be completed at the end of the acceptance phase due to ambient conditions, schedule issues or other conditions preventing testing during the normal acceptance testing period.

Deficiency: See "Commissioning Issue".

Design Criteria: A listing of the VA Design Criteria outlining the project design requirements, including its source. These are used during the design process to show the design elements meet the OPR.

Design Intent: The overall term that includes the OPR and the BOD. It is a detailed explanation of the ideas, concepts, and criteria that are defined by the owner to be important. The design intent documents are utilized to provide a written record of these ideas, concepts and criteria.

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

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

Environmental Systems: Systems that use a combination of mechanical equipment, airflow, water flow and electrical energy to provide heating, ventilating, air conditioning, humidification, and dehumidification for the purpose of human comfort or process control of temperature and humidity.

Executive Summary: A section of the Commissioning report that reviews the general outcome of the project. It also includes any unresolved issues, recommendations for the resolution of unresolved issues and all deferred testing requirements.

Functionality: This defines a design component or construction process which will allow a system or component to operate or be constructed in a manner that will produce the required outcome of the OPR.

Functional Test Procedure (FTP): A written protocol that defines methods, steps, personnel, and acceptance criteria for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

Industry Accepted Best Practice: A design component or construction process that has achieved industry consensus for quality performance and functionality. Refer to the current edition of the NEBB Design Phase Commissioning Handbook for examples.

Installation Verification: Observations or inspections that confirm the system or component has been installed in accordance with the contract documents and to industry accepted best practices.

Integrated System Testing: Integrated Systems Testing procedures entail testing of multiple integrated systems performance to verify proper functional interface between systems. Typical Integrated Systems Testing includes verifying that building systems respond properly to loss of utility, transfer to emergency power sources, re-transfer from emergency power source to normal utility source; interface between HVAC controls and Fire Alarm systems for equipment shutdown, interface between Fire Alarm system and elevator control systems for elevator recall and shutdown; interface between Fire Alarm System and Security Access Control Systems to control access to spaces during fire alarm conditions; and other similar tests as determined for each specific project.

Issues Log: A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the Commissioning Team during the course of the Commissioning Process.

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

Maintainability: A design component or construction process that will allow a system or component to be effectively maintained. This includes adequate room for access to adjust and repair the equipment. Maintainability also includes components that have readily obtainable repair parts or service.

Manual Test: Testing using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the 'observation').

Owner's Project Requirements (OPR): A written document that details the project requirements and the expectations of how the building and its systems will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

Peer Review: A formal in-depth review separate from the commissioning review processes. The level of effort and intensity is much greater than a typical commissioning facilitation or extended commissioning review. The VA usually hires an independent third-party (called the IDIQ A/E) to conduct peer reviews.

Precision: The ability of an instrument to produce repeatable readings of the same quantity under the same conditions. The precision of an instrument refers to its ability to produce a tightly grouped set of values around the mean value of the measured quantity.

Pre-Design Phase Commissioning: Commissioning tasks performed prior to the commencement of design activities that includes project programming and the development of the commissioning process for the project

Pre-Functional Checklist (PFC): A form used by the contractor to verify that appropriate components are onsite, correctly installed, set up, calibrated, functional and ready for functional testing.

Pre-Functional Test (PFT): An inspection or test that is done before functional testing. PFT's include installation verification and system and component start up tests.

Procedure or Protocol: A defined approach that outlines the execution of a sequence of work or operations. Procedures are used to produce repeatable and defined results.

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

Resolution: This word has two meanings in the Cx Process. The first refers to the smallest change in a measured variable that an instrument can detect. The second refers to the implementation of actions that correct a tested or observed deficiency.

Site Observation Visit: On-site inspections and observations made by the Commissioning Agent for the purpose of verifying component, equipment, and system installation, to observe contractor testing, equipment start-up procedures, or other purposes.

Site Observation Reports (SO): Reports of site inspections and observations made by the Commissioning Agent. Observation reports are intended to provide early indication of an installation issue which will need correction or analysis.

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

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

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

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

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

Testing: The use of specialized and calibrated instruments to measure parameters such as: temperature, pressure, vapor flow, air flow, fluid flow, rotational speed, electrical characteristics, velocity, and other data in order to determine performance, operation, or function.

Testing, Adjusting, and Balancing (TAB): A systematic process or service applied to heating, ventilating and air-conditioning (HVAC) systems and other environmental systems to achieve and document air and hydronic flow rates. The standards and procedures for providing these services are referred to as “Testing, Adjusting, and Balancing” and are described in the Procedural Standards for the Testing, Adjusting and Balancing of Environmental Systems, published by NEBB or AABC.

Thermal Scans: Thermographic pictures taken with an Infrared Thermographic Camera. Thermographic pictures show the relative temperatures of objects and surfaces and are used to identify leaks, thermal bridging, thermal intrusion, electrical overload conditions, moisture containment, and insulation failure.

Training Plan: A written document that details, in outline form the expectations of the operator training. Training agendas should include instruction on how to obtain service, operate, startup, shutdown and maintain all systems and components of the project.

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

Unresolved Commissioning Issue: Any Commissioning Issue that, at the time that the Final Report or the Amended Final Report is issued that has not been either resolved by the construction team or accepted by the VA. Validation: The process by which work is verified as complete and operating correctly:

1. First party validation occurs when a firm or individual verifying the task is the same firm or individual performing the task.
2. Second party validation occurs when the firm or individual verifying the task is under the control of the firm performing the task or has other possibilities of financial conflicts of interest in the resolution (Architects, Designers, General Contractors and Third Tier Subcontractors or Vendors).
3. Third party validation occurs when the firm verifying the task is not associated with or under control of the firm performing or designing the task.

Verification: The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner’s Project Requirements.

Warranty Phase Commissioning: Commissioning efforts executed after a project has been completed and accepted by the Owner. Warranty Phase Commissioning includes follow-up on verification of system performance, measurement and verification tasks and assistance in identifying warranty issues and enforcing warranty provisions of the construction contract.

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

Whole Building Commissioning: Commissioning of building systems such as Building Envelope, HVAC, Electrical, Special Electrical (Fire Alarm, Security & Communications), Plumbing and Fire Protection as described in this specification.

1.7 SYSTEMS TO BE COMMISSIONED

A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.

B. The following systems will be commissioned as part of this project:

Systems To Be Commissioned	
System	**Description**
Building Exterior Closure	
Foundations (excluding structural)	Standard, special, slab-on-grade, vapor barriers, air barriers
Basements	Basement walls, crawl spaces, waterproofing, drainage
Superstructure	Floor construction, roof construction, sunshades, connections to adjacent structures
Exterior Closure	Exterior walls, exterior windows, exterior doors, louvers, grilles and sunscreens,
Roofing	Roof system (including parapet), roof openings (skylights, pipe chases, ducts, equipment curbs, etc.)
Note:	The emphasis on commissioning the above building envelope systems is on control of air flow, heat flow, noise, infrared, ultraviolet, rain penetration, moisture, durability, security, reliability, constructability, maintainability, and sustainability.
Specialties	
Patient Bed Service Walls	Medical gas certification and cross check, electrical connections

Systems To Be Commissioned	
System	**Description**
Equipment	
Parking Control Equipment	Barriers
Laboratory Fume Hoods	Fume Hood Certification
Biological Safety Cabinets	Cabinet Certification
Packaged Incinerators	Combustion Testing, Cycle Certification
Conveying Equipment	
Electric Dumbwaiters	Interface with other systems (Fire Alarm, etc.) [ASTM testing and certification by others]
Elevators	Interface with other systems (fire alarm, etc.) [ASTM testing and certification by others]
Escalators	Interface with other systems (fire alarm, etc.) [ASTM testing and certification by others]
Material Delivery Systems	Interface with other systems (fire alarm, elevators, etc.)
Pneumatic Tube Systems	Interface with other systems (fire alarm, etc.)
Fire Suppression	
Fire Pump	Fire Pump, jockey pump, fire pump controller/ATS
Fire Sprinkler Systems	Wet pipe system, dry pipe system, pre-action system, special agent systems
Plumbing	
Domestic Water Distribution	Booster pumps, backflow preventers, water softeners, potable water storage tanks
Domestic Hot Water Systems	Water heaters**, heat exchangers, circulation pumps, point-of-use water heaters*
Sewerage Pump Systems	Sewage ejectors
Wastewater Pump Systems	Sump pumps

Systems To Be Commissioned	
System	**Description**
Sanitary Waste Interceptors	Grease interceptors, acid neutralizers
General Service Air Systems	Packaged compressor systems, air dryers, filtration
Medical Air Systems	Packaged medical air compressor units. Outlet certification, cross-connection verification
Medical Vacuum Systems	Packaged medical vacuum units, outlet certification, cross-connection verification
Dental Air Systems	Packaged dental air compressor units, outlet certification, cross-connect verification
Dental Evacuation and Vacuum Systems	Packaged Dental Evacuation units, packaged dental vacuum units, outlet certification, cross-connection verification
Waste Anesthesia Gas Systems	Packaged Waste Anesthesia Gas units, outlet certification, cross-connection verification
Medical Gas Systems (other than Medical Air Systems)	Medical gas (oxygen, nitrogen, nitrous oxide, etc.) tank/manifold systems, outlet certification, cross-connection verification
Chemical Waste Systems	Chemical storage tanks, neutralization systems, ventilation, process control
Reverse-Osmosis Systems	Packaged Reverse-Osmosis systems
Water De-Alkalizing Systems	Package Water De-Alkalizing systems
HVAC	
Noise and Vibration Control	Noise and vibration levels for critical equipment such as Air Handlers, Chillers, Cooling Towers, Boilers, Generators, etc. will be commissioned as part of the system commissioning

Systems To Be Commissioned	
System	**Description**
Direct Digital Control System**	Operator Interface Computer, Operator Work Station (including graphics, point mapping, trends, alarms), Network Communications Modules and Wiring, Integration Panels. [DDC Control panels will be commissioned with the systems controlled by the panel]
Chilled Water System**	Chillers (centrifugal, rotary screw, air-cooled), pumps (primary, secondary, variable primary), VFDs associated with chilled water system components, DDC Control Panels (including integration with Building Control System)
Condenser Water System**	Cooling Towers, Fluid Coolers, heat exchangers/economizers, pumps, VFDs associated with condenser water system components, DDC control panels.
Steam/Heating Hot Water System**	Boilers, boiler feed water system, economizers/heat recovery equipment, condensate recovery, water treatment, boiler fuel system, controls, interface with facility DDC system.
HVAC Air Handling Systems**	Air handling Units, packaged rooftop AHU, Outdoor Air conditioning units, humidifiers, DDC control panels
HVAC Ventilation/Exhaust Systems	General exhaust, toilet exhaust, laboratory exhaust, isolation exhaust, room pressurization control systems
HVAC Energy Recovery Systems**	Heat Wheels, Heat Recovery Loops, AHU Integrated Heat Recovery
HVAC Terminal Unit Systems**	VAV Terminal Units, CAV terminal units, fan coil units, fin-tube radiation, unit heaters
Decentralized Unitary HVAC Systems*	Split-system HVAC systems, controls, interface with facility DDC

Systems To Be Commissioned	
System	**Description**
Unitary Heat Pump Systems**	Water-source heat pumps, controls, interface with facility DDC
Humidity Control Systems	Humidifiers, de-humidifiers, controls, interface with facility DDC
Hydronic Distribution Systems	Pumps, DDC control panels, heat exchangers,
Facility Fuel Systems	Boiler fuel system, generator fuel system
Geothermal Energy Direct Use Heating **	Geothermal well, ground heat exchanger, geothermal pumps, heat exchanger, valves, instrumentation
Solar Energy Heating Systems **	Solar collectors, heat exchangers, storage tanks, solar-boosted domestic hot water heater, pumps, valves, instrumentation
Facility Fuel Gas Systems	Witness Natural gas piping pressure testing, natural gas compressors and storage, propane storage
Smoke Evacuation System	Atrium smoke evacuation, other smoke evacuation and smoke management systems, controls, interface with other systems (fire alarm), emergency operation.
Electrical	
Medium-Voltage Electrical Distribution Systems	Medium-Voltage Switchgear, Medium-Voltage Switches, Underground ductbank and distribution, Pad-Mount Transformers, Medium-Voltage Load Interrupter Switches,
Grounding & Bonding Systems	Witness 3rd party testing, review reports
Electric Power Monitoring Systems	Metering, sub-metering, power monitoring systems, PLC control systems
Electrical System Protective Device Study	Review reports, verify field settings consistent with Study

Systems To Be Commissioned	
System	**Description**
Secondary Unit Substations	Medium-voltage components, transformers, low-voltage distribution, verify breaker testing results (injection current, etc)
Low-Voltage Distribution System	Normal power distribution system, Life-safety power distribution system, critical power distribution system, equipment power distribution system, switchboards, distribution panels, panelboards, verify breaker testing results (injection current, etc)
Emergency Power Generation Systems	Generators, Generator paralleling switchgear, automatic transfer switches, PLC and other control systems
Lighting & Lighting Control** Systems	Emergency lighting, occupancy sensors, lighting control systems, architectural dimming systems, theatrical dimming systems, exterior lighting and controls
Cathodic Protection Systems	Review 3rd party testing results.
Lightning Protection System	Witness 3rd party testing, review reports
Communications	
Grounding & Bonding System	Witness 3rd party testing, review reports
Structured Cabling System	Witness 3rd party testing, review reports
Master Antenna Television System	Witness 3rd party testing, review reports
Public Address & Mass Notification Systems	Witness 3rd party testing, review reports
Intercom & Program Systems	Witness 3rd party testing, review reports

Systems To Be Commissioned	
System	**Description**
Nurse Call & Code Blue Systems	Witness 3rd party testing, review reports
Security Emergency Call Systems	Witness 3rd party testing, review reports
Duress Alarm Systems	Witness 3rd party testing, review reports
Electronic Safety and Security	
Grounding & Bonding	Witness 3rd party testing, review reports
Physical Access Control Systems	Witness 3rd party testing, review reports
Access Control Systems	Witness 3rd party testing, review reports
Security Access Detection Systems	Witness 3rd party testing, review reports
Video Surveillance System	Witness 3rd party testing, review reports
Electronic Personal Protection System	Witness 3rd party testing, review reports
Fire Detection and Alarm System	100% device acceptance testing, battery draw-down test, verify system monitoring, verify interface with other systems.
Renewable Energy Sources	
Geothermal Energy Electrical Generation Systems **	Geothermal well, DC-AC Inverters, storage batteries, turbine generator modules, switchgear, combiner boxes, instrumentation, monitoring and control systems
Solar Energy Electrical Power Generation Systems **	Solar collector modules, DC-AC inverter, storage batteries, combiners, Switchgear, instrumentation, monitoring and control systems
Wind Energy Electrical Power Generation Systems **	Wind Turbines, DC-AC inverter, storage batteries, combiners, switchgear, instrumentation, monitoring and control systems
Site Utilities	

Systems To Be Commissioned	
System	**Description**
Water Utilities	City Water Service Entrance, Backflow Prevention, Pressure Control, Booster Pumps, Irrigation Systems
Sanitary Sewerage Utilities	City Sanitary Connection, Waste Treatment Systems
Storm Drainage Utilities	City Storm Water Connection, Site Storm Water Distribution
Energy Distribution Utilities	Connection to Third Party Energy (Steam, High Temp Hot Water, Chilled Water) Supply Systems, Metering, Pressure Control
Transportation	
Active Traffic Barrier Systems	Witness 3rd party testing
Integrated Systems Tests	
Loss of Power Response	Loss of power to building, loss of power to campus, restoration of power to building, restoration of power to campus.
Fire Alarm Response	Integrated System Response to Fire Alarm Condition and Return to Normal
Table Notes	
** Denotes systems that LEED requires to be commissioned to comply with the LEED Fundamental Commissioning pre-requisite.	

1.8 COMMISSIONING TEAM

A. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, schedulers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and Commissioning Agent.

B. Members Appointed by Contractor:

1. Contractor’ Commissioning Manager: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.

2. Contractor’s Commissioning Representative(s): Individual(s), each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions.

C. Members Appointed by VA:

1. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The VA will engage the CxA under a separate contract.
2. User: Representatives of the facility user and operation and maintenance personnel.
3. A/E: Representative of the Architect and engineering design professionals.

1.9 VA'S COMMISSIONING RESPONSIBILITIES

A. Appoint an individual, company or firm to act as the Commissioning Agent.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:

1. Coordination meetings.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Testing meetings.
4. Witness and assist in Systems Functional Performance Testing.
5. Demonstration of operation of systems, subsystems, and equipment.

C. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

1.10 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

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

B. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.

C. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of the subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
   1. Participate in commissioning coordination meetings.
   2. Conduct operation and maintenance training sessions in accordance with approved training plans.
   3. Verify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
   4. Evaluate commissioning issues and commissioning observations identified in the Commissioning Issues Log, field reports, test reports or other commissioning documents. In collaboration with entity responsible for system and equipment installation, recommend corrective action.
   5. Review and comment on commissioning documentation.
   6. Participate in meetings to coordinate Systems Functional Performance Testing.
   7. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Commissioning Agent for incorporation into the commissioning plan.
   8. Provide information to the Commissioning Agent for developing commissioning plan.
   9. Participate in training sessions for VA's operation and maintenance personnel.
   10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

1.11 COMMISSIONING AGENT'S RESPONSIBILITIES

A. Organize and lead the commissioning team.
B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.
C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment,

including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.

D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.

E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.

F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.

G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.

H. Coordinate Systems Functional Performance Testing schedule with the Contractor.

I. Witness selected systems startups.

J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.

K. Witness and document Systems Functional Performance Testing.

L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.

M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.

N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.

O. Prepare commissioning Field Observation Reports.

P. Prepare the Final Commissioning Report.

Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

R. Assemble the final commissioning documentation, including the Final Commissioning Report and Addendum to the Final Commissioning Report.

1.12 COMMISSIONING DOCUMENTATION

A. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
3. Identification of systems and equipment to be commissioned.
4. Schedule of Commissioning Coordination meetings.
5. Identification of items that must be completed before the next operation can proceed.
6. Description of responsibilities of commissioning team members.

7. Description of observations to be made.
8. Description of requirements for operation and maintenance training.
9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
12. Preliminary Systems Functional Performance Test procedures.

B. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:
1. Name and identification code of tested system.
2. Test number.
3. Time and date of test.
4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
5. Dated signatures of the person performing test and of the witness, if applicable.
6. Individuals present for test.
7. Observations and Issues.
8. Issue number, if any, generated as the result of test.

C. Pre-Functional Checklists: The Commissioning Agent will prepare Pre-Functional Checklists. Pre-Functional Checklists shall be completed and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify

accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.

D. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

E. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results.

F. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.

1. Creating an Commissioning Issues Log Entry:
   a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
   b. Assign a descriptive title for the issue.
   c. Identify date and time of the issue.
   d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
   e. Identify system, subsystem, and equipment to which the issue applies.

f. Identify location of system, subsystem, and equipment.
g. Include information that may be helpful in diagnosing or evaluating the issue.
h. Note recommended corrective action.
i. Identify commissioning team member responsible for corrective action.
j. Identify expected date of correction.
k. Identify person that identified the issue.

2. Documenting Issue Resolution:
a. Log date correction is completed or the issue is resolved.
b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
c. Identify changes to the Contract Documents that may require action.
d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
e. Identify person(s) who corrected or resolved the issue.
f. Identify person(s) verifying the issue resolution.

G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
2. Commissioning plan.

3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
5. Commissioning Issues Log.
6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.

H. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:

1. Documentation of deferred and off season test(s) results.
2. Completed Systems Functional Performance Test Procedures for off season test(s).
3. Documentation that unresolved system performance issues have been resolved.
4. Updated Commissioning Issues Log, including status of unresolved issues.
5. Identification of potential Warranty Claims to be corrected by the Contractor.

I. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual. The Systems Manual will include, but is not limited to, the following:

1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.
2. Reference to Final Commissioning Plan.
3. Reference to Final Commissioning Report.
4. Approved Operation and Maintenance Data as submitted by the Contractor.

1.13 SUBMITTALS

A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included

as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:

1. The Commissioning Team: A list of commissioning team members by organization.
2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.
5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.
6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system’s testing.

B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor’s project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The

Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.

C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.

D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.

E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.

F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA COR with copies to the Contractor and Architect.

G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three electronic copies of the preliminary commissioning report. One electronic copy, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.

H. Final Commissioning Report Submittal: The Commissioning Agent will submit four sets of electronically formatted information of the final commissioning report to the VA. The final submittal will incorporate comments as directed by the VA.

I. Data for Commissioning:

1. The Commissioning Agent will request in writing from the Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Commissioning Plan.
2. The Commissioning Agent may request further documentation as is necessary for the commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.

1.14 COMMISSIONING PROCESS

A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.

B. Within 15 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CxM) to manage and lead the commissioning effort on behalf of the Contractor. The Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.

C. Within 15 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CXR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

1.15 QUALITY ASSURANCE

A. Instructor Qualifications: Factory authorized service representatives shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.

B. Test Equipment Calibration: The Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.16 COORDINATION

A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will

submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.

B. Scheduling: The Contractor shall work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information (including, but not limited to, tasks, durations and predecessors) on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.

C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.

D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.

F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing.

Test equipment required for Systems Functional Performance Testing will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.

B. Data logging equipment and software required to test equipment shall be provided by the Contractor.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 °C (1.0 °F) and a resolution of + or - 0.1 °C (0.2 °F). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES

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

Construction Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes
Meetings	Construction Commissioning Kick Off meeting	L	A	P	P	O	
	Commissioning Meetings	L	A	P	P	O	
	Project Progress Meetings	P	A	P	L	O	
	Controls Meeting	L	A	P	P	O	
Coordination	Coordinate with [OGC's, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support the OPR and BOD.	L	A	P	P	N/A	
Cx Plan & Spec	Final Commissioning Plan	L	A	R	R	O	
Schedules	Duration Schedule for Commissioning Activities	L	A	R	R	N/A	

Construction Phase		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes
OPR and BOD	Maintain OPR on behalf of Owner	L	A	R	R	O	
	Maintain BOD/DID on behalf of Owner	L	A	R	R	O	
Document Reviews	TAB Plan Review	L	A	R	R	O	
	Submittal and Shop Drawing Review	R	A	R	L	O	
	Review Contractor Equipment Startup Checklists	L	A	R	R	N/A	
	Review Change Orders, ASI, and RFI	L	A	R	R	N/A	
Site Observations	Witness Factory Testing	P	A	P	L	O	
	Construction Observation Site Visits	L	A	R	R	O	
Functional Test Protocols	Final Pre-Functional Checklists	L	A	R	R	O	
	Final Functional Performance Test Protocols	L	A	R	R	O	
Technical Activities	Issues Resolution Meetings	P	A	P	L	O	

Construction Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes
Reports and Logs	Status Reports	L	A	R	R	O	
	Maintain Commissioning Issues Log	L	A	R	R	O	

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

Acceptance Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes
Meetings	Commissioning Meetings	L	A	P	P	O	
	Project Progress Meetings	P	A	P	L	O	
	Pre-Test Coordination Meeting	L	A	P	P	O	
	Lessons Learned and Commissioning Report Review Meeting	L	A	P	P	O	

Acceptance Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes
Coordination	Coordinate with [OGC's, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support OPR and BOD	L	P	P	P	O	
Cx Plan & Spec	Maintain/Update Commissioning Plan	L	A	R	R	O	
Schedules	Prepare Functional Test Schedule	L	A	R	R	O	
OPR and BOD	Maintain OPR on behalf of Owner	L	A	R	R	O	
	Maintain BOD/DID on behalf of Owner	L	A	R	R	O	
Document Reviews	Review Completed Pre-Functional Checklists	L	A	R	R	O	
	Pre-Functional Checklist Verification	L	A	R	R	O	
	Review Operations & Maintenance Manuals	L	A	R	R	R	
	Training Plan Review	L	A	R	R	R	
	Warranty Review	L	A	R	R	O	

Acceptance Phase		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes
	Review TAB Report	L	A	R	R	O	
Site Observations	Construction Observation Site Visits	L	A	R	R	O	
	Witness Selected Equipment Startup	L	A	R	R	O	
Functional Test Protocols	TAB Verification	L	A	R	R	O	
	Systems Functional Performance Testing	L	A	P	P	P	
	Retesting	L	A	P	P	P	
Technical Activities	Issues Resolution Meetings	P	A	P	L	O	
	Systems Training	L	S	R	P	P	
Reports and Logs	Status Reports	L	A	R	R	O	
	Maintain Commissioning Issues Log	L	A	R	R	O	
	Final Commissioning Report	L	A	R	R	R	
	Prepare Systems Manuals	L	A	R	R	R	

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

Warranty Phase		CxA = Commissioning Agent COR = Contracting Officer's Representative A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	COR	A/E	PC	O&M	Notes
Meetings	Post-Occupancy User Review Meeting	L	A	O	P	P	
Site Observations	Periodic Site Visits	L	A	O	O	P	
Functional Test Protocols	Deferred and/or seasonal Testing	L	A	O	P	P	
Technical Activities	Issues Resolution Meetings	L	S	O	O	P	
	Post-Occupancy Warranty Checkup and review of Significant Outstanding Issues	L	A		R	P	
Reports and Logs	Final Commissioning Report Amendment	L	A		R	R	
	Status Reports	L	A		R	R	

3.2 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS

A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.

1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.
   a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
   b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.
2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.
   a. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
   b. The full startup plan shall at a minimum consist of the following items:
      1) The Pre-Functional Checklists.
      2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
      3) The manufacturer's normally used field checkout sheets.

c. The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.
d. The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.

3. Sensor and Actuator Calibration
   a. All field installed temperature, relative humidity, CO2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 22, Division 26, and Division 27 specifications.
   b. All procedures used shall be fully documented on the Pre-Functional Checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
4. Execution of Equipment Startup
   a. Four weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
   b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
   c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
   d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

3.3 DEFICIENCIES, NONCONFORMANCE, AND APPROVAL IN CHECKLISTS AND STARTUP

A. The Contractor shall clearly list any outstanding items of the initial startup and Pre-Functional Checklist procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the VA and the Commissioning Agent within two days of completion.

B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the VA and others as necessary. The Contractor shall correct all areas that are noncompliant or incomplete in the checklists in a timely manner, and shall notify the VA and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the original noncompliance report. When satisfactorily completed, the Commissioning Agent will recommend approval of the checklists and startup of each system to the VA.

C. The Contractor shall be responsible for resolution of deficiencies as directed the VA.

3.4 PHASED COMMISSIONING

A. The project may require startup and initial checkout to be executed in phases. This phasing shall be planned and scheduled in a coordination meeting of the VA, Commissioning Agent, and the Contractor. Results will be added to the master construction schedule and the commissioning schedule.

3.5 DDC SYSTEM TRENDING FOR COMMISSIONING

A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.

B. Alarms are a means to notify the system operator that abnormal conditions are present in the system. Alarms shall be structured into three tiers – Critical, Priority, and Maintenance.

1. Critical alarms are intended to be alarms that require the immediate attention of and action by the Operator. These alarms shall be displayed on the Operator Workstation in a popup style window that is graphically linked to the associated unit's graphical display. The popup style window shall be displayed on top of any active window within the screen, including non DDC system software.
2. Priority level alarms are to be printed to a printer which is connected to the Operator’s Work Station located within the engineer’s office. Additionally Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from

the operator or maintenance personnel within a normal work shift, and not immediate action.

3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.

C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more effectively program, view, manipulate and test control devices while being in the same room as the controlled device.

D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the COR and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:

1. Pre-testing, Testing, and Post-testing – Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the COR. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the COR, prior to the execution of Systems Functional Performance Testing.

2. Dynamic plotting – The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.
3. Graphical plotting - The graphical plots shall be provided with a dual y-axis allowing 15 or more trend points (series) plotted simultaneously on the graph with each series in distinct color. The plots will further require title, axis naming, legend etc. all described by the Systems Functional Performance Test Procedure. If this cannot be sufficiently accomplished directly in the Direct Digital Control System then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.
4. The following tables indicate the points to be trended and alarmed by system. The Operational Trend Duration column indicates the trend duration for normal operations. The Testing Trend Duration column indicates the trend duration prior to Systems Functional Performance Testing and again after Systems Functional Performance Testing. The Type column indicates point type: AI = Analog Input, AO = Analog Output, DI = Digital Input, DO = Digital Output, Calc = Calculated Point. In the Trend Interval Column, COV = Change of Value. The Alarm Type indicates the alarm priority; C = Critical, P = Priority, and M = Maintenance. The Alarm Range column indicates when the point is considered in the alarm state. The Alarm Delay column indicates the length of time the point must remain in an alarm state before the alarm is recorded in the DDC. The intent is to allow minor, short-duration events to be corrected by the DDC system prior to recording an alarm.

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
OA Temperature	AI	15 Min	24 hours	3 days	N/A		

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
RA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Humidity	AI	15 Min	24 hours	3 days	P	>60% RH	10 min
Mixed Air Temp	AI	None	None	None	N/A		
SA Temp	AI	15 Min	24 hours	3 days	C	±5°F from SP	10 min
Supply Fan Speed	AI	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AI	15 Min	24 hours	3 days	N/A		
RA Pre-Filter Status	AI	None	None	None	N/A		
OA Pre-Filter Status	AI	None	None	None	N/A		
After Filter Status	AI	None	None	None	N/A		
SA Flow	AI	15 Min	24 hours	3 days	C	±10% from SP	10 min
OA Supply Temp	AI	15 Min	24 hours	3 days	P	±5°F from SP	10 min
RA Supply Temp	AI	15 Min	24 hours	3 days	N/A		
RA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA HW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
RA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
Initial UVC Intensity (%)	AI	None	None	None	N/A		
Duct Pressure	AI	15 Min	24 hours	3 days	C	±25% from SP	6 min
CO2 Level	AI	15 Min	24 hours	3 days	P	±10% from SP	10 min
Supply Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Return Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 Min
High Static Status	DI	COV	24 hours	3 days	P	True	1 min
Fire Alarm Status	DI	COV	24 hours	3 days	C	True	5 min
Freeze Stat Level 1	DI	COV	24 hours	3 days	C	True	10 min
Freeze Stat Level 2	DI	COV	24 hours	3 days	C	True	5 min
Freeze Stat Level 3	DI	COV	24 hours	3 days	P	True	1 min
Fire/Smoke Damper Status	DI	COV	24 hours	3 days	P	Closed	1 min
Emergency AHU Shutdown	DI	COV	24 hours	3 days	P	True	1 min
Exhaust Fan #1 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Exhaust Fan #2 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #3 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
OA Alarm	DI	COV	24 hours	3 days	C	True	10 min
High Static Alarm	DI	COV	24 hours	3 days	C	True	10 min
UVC Emitter Alarm	DI	COV	24 hours	3 days	P	True	10 min
CO2 Alarm	DI	COV	24 hours	3 days	P	True	10 min
Power Failure	DI	COV	24 hours	3 days	P	True	1 min
Supply Fan Speed	AO	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AO	15 Min	24 hours	3 days	N/A		
RA CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
OA CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
OA HW Valve Position	AO	15 Min	24 hours	3 days	N/A		
Supply Fan S/S	DO	COV	24 hours	3 days	N/A		
Return Fan S/S	DO	COV	24 hours	3 days	N/A		

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Fire/Smoke Dampers	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
AHU Energy	Calc	1 Hour	30 day	N/A	N/A		

Terminal Unit (VAV, CAV, etc.) Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Space Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Air Flow	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Local Setpoint	AI	15 Min	12 hours	3 days	M	±10°F from SP	60 min
Space Humidity	AI	15 Min	12 hours	3 days	P	> 60% RH	5 min
Unoccupied Override	DI	COV	12 hours	3 days	M	N/A	12 Hours
Refrigerator Alarm	DI	COV	12 hours	3 days	C	N/A	10 min

Terminal Unit (VAV, CAV, etc.) Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Damper Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		

4-Pipe Fan Coil Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Pre-Filter Status	AI	None	None	None	M	> SP	1 hour
Water Sensor	DI	COV	12 hours	3 days	M	N/A	30 Min
Cooling Coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Fan Coil ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

2-Pipe Fan Coil Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Pre-Filter Status	AI	None	None	None	M	> SP	1 hour
Water Sensor	DI	COV	12 hours	3 days	M	N/A	30 Min
Cooling Coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Fan Coil ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

Unit Heater Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Heating Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Unit Heater ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

Steam and Condensate Pumps Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Steam Flow (LB/HR)	AI	15 Minutes	12 hours	3 days	N/A		
Condensate Pump Run Hours	AI	15 Minutes	12 hours	3 days	N/A		
Water Meter (GPM)	AI	15 Minutes	12 hours	3 days	N/A		
Electric Meter (KW/H)	AI	15 Minutes	12 hours	3 days	N/A		
Irrigation Meter (GPM)	AI	15 Minutes	12 hours	3 days	N/A		
Chilled Water Flow (TONS)	AI	15 Minutes	12 hours	3 days	N/A		
Condensate Flow (GPM)	AI	15 Minutes	12 hours	3 days	N/A		
High Water Level Alarm	DI	COV	12 hours	3 days	C	True	5 Min
Condensate Pump Start/Stop	DO	COV	12 hours	3 days	P	Status <> Command	10 min

Domestic Hot Water Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Domestic HW Setpoint WH-1	AI	15 Minute	12 Hours	3 days	N/A		
Domestic HW Setpoint WH-2	AI	15 Minute	12 Hours	3 days	N/A		

Domestic Hot Water Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	C	> 135 oF	10 Min
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	P	±5°F from SP	10 Min
Dom. Circ. Pump #1 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Dom. Circ. Pump #2 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Dom. Circ. Pump #1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Dom. Circ. Pump #2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Domestic HW Start/Stop	DO	COV	12 Hours	3 days	N/A		

Hydronic Hot Water Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
System HWS Temperature	AI	15 min	12 hours	3 days	C	±5°F from SP	10 Min
System HWR Temperature	AI	15 min	12 hours	3 days	M	±15°F from SP	300 Min
HX-1 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min

Hydronic Hot Water Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
HX-2 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Leaving Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
System Flow (GPM)	AI	15 min	12 hours	3 days	N/A		
System Differential Pressure	AI	15 min	12 hours	3 days	P	±10% from SP	8 Min
				3 days			
HW Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 1 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 2 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #1 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #1 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		

Hydronic Hot Water Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Steam Station #2 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #2 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station Bypass Valve Position	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HW Pump 2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HWR #1 Valve	DO	COV	12 Hours	3 days	N/A		
HWR #2 Valve	DO	COV	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Chiller 1 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5˚F from SP	10 Min
Chiller 1 Flow	AI	15 Minutes	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Chiller 1 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller 2 Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Decoupler Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min

Chilled Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Secondary Loop Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Primary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Chiller 1 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Chiller 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 2 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 2 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 2 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Detector	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Exhaust Fan Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Emergency Shutdown	DI	COV	12 Hours	3 days	P	True	1 Min
Primary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Secondary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Chiller 1 Enable	DO	COV	12 Hours	3 days	N/A		
Chiller 1 Iso-Valve Command	DO	COV	12 Hours	3 days	N/A		
Chiller 2 Enable	DO	COV	12 Hours	3 days	N/A		
Chiller 2 Iso-Valve Command	DO	COV	12 Hours	3 days	N/A		
Refrigerant Exhaust Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		

Condenser Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Chiller 1 Condenser Entering Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Condenser Leaving Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Condenser Entering Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Condenser Leaving Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Basin Temp	AI	15 Minutes	12 Hours	3 days	P	< 45 oF	10 Min
Cooling Tower 2 Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Basin Temp	AI	15 Minutes	12 Hours	3 days	P	< 45 oF	10 Min
Condenser Water Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Condenser Water Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Outdoor Air Wet Bulb	AI	15 Minutes	12 Hours	3 days	N/A		

Condenser Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Cooling Tower 1 Fan Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Cooling Tower 1 Basin Heat	DI	COV	12 Hours	3 days	N/A		
Cooling Tower 1 Heat Trace	DI	COV	12 Hours	3 days	N/A		
Cooling Tower 2 Fan Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Cooling Tower 2 Basin Heat	DI	COV	12 Hours	3 days	N/A		
Cooling Tower 2 Heat Trace	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Isolation Valve	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Chiller 2 Isolation Valve	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Condenser Water Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Condenser Water Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Chiller 1 Condenser Bypass Valve	AO	15 Minutes	12 Hours	3 days	N/A		

Condenser Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Chiller 2 Condenser By-Pass Valve	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Bypass Valve	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Fan Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Bypass Valve	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Fan Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		
Cooling Tower 2 Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		
Condenser Water Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Condenser Water Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		

Steam Boiler System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Boiler 1 Steam Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min
Boiler 1 Steam Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Steam Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min
Boiler 2 Steam Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
System Steam Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min
Boiler 1 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 1 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Boiler 1 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Low Water Alarm	DI	COV	12 Hours	3 days	C	True	5 Min
Boiler 1 High Water Alarm	DI	COV	12 Hours	3 days	C	True	5 Min

Steam Boiler System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Boiler 1 Feed Pump	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 2 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Boiler 2 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Low Water Alarm	DI	COV	12 Hours	3 days	C	True	5 Min
Boiler 2 High Water Alarm	DI	COV	12 Hours	3 days	C	True	5 Min
Boiler 2 Feed Pump	DI	COV	12 Hours	3 days	N/A		
Combustion Damper Status	DI	COV	12 Hours	3 days	P	Status <> Command	5 min
Condensate Recovery Pump Status	DI	COV	12 Hours	3 days	P	Status <> Command	5 min
Boiler 1 Feed Pump Start / Stop	DO	COV	12 Hours	3 days	N/A		
Boiler 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Combustion Damper Command	DO	COV	12 Hours	3 days	N/A		

Steam Boiler System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Condensate Recovery Pump Start / Stop	DO	COV	12 Hours	3 days	N/A		

Hot Water Boiler System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Outside Air Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Entering Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Leaving Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Entering Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Leaving Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Hot Water Supply Temperature	AI	15 Minutes	12 Hours	3 days	P	±5 oF from SP	10 Min

Hot Water Boiler System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Hot Water Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	C	±5% from SP	10 Min
Lead Boiler	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 1 Isolation Valve	DI	COV	12 Hours	3 days	N/A		
Boiler 1 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Boiler 2 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 2 Isolation Valve	DI	COV	12 Hours	3 days	N/A		
Boiler 2 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		

Hot Water Boiler System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Boiler 2 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Combustion Dampers Open	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Secondary Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Secondary Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 1 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Primary Pump 2 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Hot Water System Enable	DO	COV	12 Hours	3 days	N/A		

Hot Water Boiler System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Combustion Dampers Command	DO	COV	12 Hours	3 days	N/A		
Primary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		

E. The Contractor shall provide the following information prior to Systems Functional Performance Testing. Any documentation that is modified after submission shall be recorded and resubmitted to the COR and Commissioning Agent.
   1. Point-to-Point checkout documentation;
   2. Sensor field calibration documentation including system name, sensor/point name, measured value, DDC value, and Correction Factor.
   3. A sensor calibration table listing the referencing the location of procedures to following in the O&M manuals, and the frequency at which calibration should be performed for all sensors, separated by system, subsystem, and type. The calibration requirements shall be submitted both in the O&M manuals and separately in a standalone document containing all sensors for inclusion in the commissioning documentation. The following table is a sample that can be used as a template for submission.

SYSTEM		
Sensor	**Calibration Frequency**	**O&M Calibration Procedure Reference**
Discharge air temperature	Once a year	Volume I Section D.3.aa
Discharge static pressure	Every 6 months	Volume II Section A.1.c

4. Loop tuning documentation and constants for each loop of the building systems. The documentation shall be submitted in outline or table separated by system, control type (e.g. heating valve temperature control); proportional, integral and derivative constants, interval (and bias if used) for each loop. The following table is a sample that can be used as a template for submission.

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

3.6 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.

B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power

failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.

D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form. Representative test formats and examples are found in the Commissioning Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms developed by the Commissioning Agent will include, but not be limited to, the following information:

1. System and equipment or component name(s)
2. Equipment location and ID number
3. Unique test ID number, and reference to unique Pre-Functional Checklists and startup documentation, and ID numbers for the piece of equipment
4. Date
5. Project name
6. Participating parties
7. A copy of the specification section describing the test requirements

8. A copy of the specific sequence of operations or other specified parameters being verified
9. Formulas used in any calculations
10. Required pretest field measurements
11. Instructions for setting up the test.
12. Special cautions, alarm limits, etc.
13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
15. A section for comments.
16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.

E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.
   1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.
   2. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.
5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.

F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.

G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.

H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be

considered a justified reason for a claim of delay or for a time extension by the Contractor.

I. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days' notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.

J. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems will be checked.

K. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

3.7 DOCUMENTATION, NONCONFORMANCE AND APPROVAL OF TESTS

A. Documentation: The Commissioning Agent will witness, and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to the VA and the Contractor for review and approval. The Contractor shall include the filled out forms with the O&M manual data.

B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the VA on Commissioning Field Reports and/or the Commissioning Master Issues Log.
   1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and resolution shall be documented on the Systems Functional Test Procedure.
   2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the VA.
   3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.
   4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:
      a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the Commissioning Agent will submit a Commissioning Field Report to the VA. The Commissioning Agent will also note items of noncompliance and the Contractor’s response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the VA and the Commissioning Agent.
      b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.

5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:
   a. The item of noncompliance shall be documented on the test form with the Contractor's response. The item of noncompliance with the Contractor’s response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.
   b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive and acceptance authority is with the Department of Veterans Affairs.
   c. The Commissioning Agent will document the resolution process.
   d. Once the interpretation and resolution have been decided, the Contractor shall correct the item of noncompliance, report it to the Commissioning Agent. The requirement for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test. Retesting shall be repeated until satisfactory performance is achieved.

C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

D. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform in compliance with the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the VA. In such case, the Contractor shall provide the VA with the following:
   1. Within one week of notification from the VA, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the VA within two weeks of the original notice.
   2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem,

cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

3. The VA shall determine whether a replacement of all identical units or a repair is acceptable.
4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.
5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

E. Approval: The Commissioning Agent will note each satisfactorily demonstrated function on the test form. Formal approval of the Systems Functional Performance Test shall be made later after review by the Commissioning Agent and by the VA. The Commissioning Agent will evaluate each test and report to the VA using a standard form. The VA will give final approval on each test using the same form, and provide signed copies to the Commissioning Agent and the Contractor.

3.8 DEFERRED TESTING

A. Unforeseen Deferred Systems Functional Performance Tests: If any Systems Functional Performance Test cannot be completed due to the building structure, required occupancy condition or other conditions, execution of the Systems Functional Performance Testing may be delayed upon approval of the VA. These Systems Functional Performance Tests shall be conducted in the same manner as the seasonal tests as soon as possible. Services of the Contractor to conduct these unforeseen Deferred Systems Functional Performance Tests shall be negotiated between the VA and the Contractor.

B. Deferred Seasonal Testing: Deferred Seasonal Systems Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Systems Functional Performance Tests should be deferred until weather

conditions more closely match systems parameters. The Contractor shall review and comment on the proposed schedule for Deferred Seasonal Testing. The VA will review and approve the schedule for Deferred Seasonal Testing. Deferred Seasonal Systems Functional Performances Tests shall be witnessed and documented by the Commissioning Agent. Deferred Seasonal Systems Functional Performance Tests shall be executed by the Contractor in accordance with these specifications.

3.9 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's COR, VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.

B. The Contractor shall provide training and demonstration as required by other Division 22, Division 26, and Division 27 sections. The Training and Demonstration shall include, but is not limited to, the following:
   1. Review the Contract Documents.
   2. Review installed systems, subsystems, and equipment.
   3. Review instructor qualifications.
   4. Review instructional methods and procedures.
   5. Review training module outlines and contents.
   6. Review course materials (including operation and maintenance manuals).
   7. Review and discuss locations and other facilities required for instruction.
   8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
   9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:
   1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors'

names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.

2. Qualification Data: Submit qualifications for facilitator and/or instructor.
3. Attendance Record: For each training module, submit list of participants and length of instruction time.
4. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
5. Demonstration and Training Recording:
   a. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
   b. Video Format: Provide high quality color DVD color on standard size DVD disks.
   c. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
   d. Narration: Describe scenes on video recording by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
   e. Submit two copies within seven days of end of each training module.
6. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

D. Quality Assurance:

1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project,

and whose work has resulted in training or education with a record of successful learning performance.

2. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
3. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

E. Training Coordination:

1. Coordinate instruction schedule with VA's operations. Adjust schedule as required to minimize disrupting VA's operations.
2. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
3. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the VA.

F. Instruction Program:

1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
   a. Fire protection systems, including fire alarm, fire pumps, and fire suppression systems.
   b. Intrusion detection systems.
   c. Conveying systems, including elevators, wheelchair lifts, escalators, and automated materials handling systems.
   d. Medical equipment, including medical gas equipment and piping.
   e. Laboratory equipment, including laboratory air and vacuum equipment and piping.
   f. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping, condensate return systems, heating hot water heat exchangers, and heating hot water distribution piping.
   g. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
   h. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.

i. HVAC instrumentation and controls.

j. Electrical service and distribution, including switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.

k. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.

l. Lighting equipment and controls.

m. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.

n. Site utilities including lift stations, condensate pumping and return systems, and storm water pumping systems.

G. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

a. System, subsystem, and equipment descriptions.

b. Performance and design criteria if Contractor is delegated design responsibility.

c. Operating standards.

d. Regulatory requirements.

e. Equipment function.

f. Operating characteristics.

g. Limiting conditions.

h. Performance curves.

2. Documentation: Review the following items in detail:

a. Emergency manuals.

b. Operations manuals.

c. Maintenance manuals.

d. Project Record Documents.

e. Identification systems.

f. Warranties and bonds.

g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning

e. Procedures for preventive maintenance.

f. Procedures for routine maintenance.

g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.

b. Repair instructions.

c. Disassembly; component removal, repair, and replacement; and reassembly instructions.

d. Instructions for identifying parts and components.

e. Review of spare parts needed for operation and maintenance.

H. Training Execution:

1. Preparation: Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual. Set up instructional equipment at instruction location.

2. Instruction:

a. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Department of Veterans Affairs for number of participants, instruction times, and location.

b. Instructor: Engage qualified instructors to instruct VA's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1) The Commissioning Agent will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.

2) The VA will furnish an instructor to describe VA's operational philosophy.

3) The VA will furnish the Contractor with names and positions of participants.

3. Scheduling: Provide instruction at mutually agreed times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with the VA and the Commissioning Agent with at least seven days' advance notice.

4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, or a written, performance-based test.
5. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

I. Demonstration and Training Recording:

1. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
2. Video Format: Provide high quality color DVD color on standard size DVD disks.
3. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
4. Narration: Describe scenes on videotape by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

- - - E N D - - -

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

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

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

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

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

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

1.3 PROTECTION

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

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

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

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

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

F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:

1. No wall or part of wall shall be permitted to fall outwardly from structures.
2. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the COR. 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 COR’s approval.

H. 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 COR. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

C. In removing buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to third floor level. Demolition of first and second stories may proceed simultaneously.

D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

E. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COR. When Utility lines are encountered that are not indicated on the drawings, the COR 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 COR. 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 COR 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 COR shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred due to such action are also the responsibility of the Asbestos Abatement Contractor.

B. Extent of Work:

1. Below is a brief description of the estimated quantities of asbestos containing materials to be abated. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy themselves of the actual quantities to be abated. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.
2. Removal, clean-up and disposal of asbestos containing materials (ACM) and asbestos/waste contaminated elements or debris in an appropriate regulated area for the following approximate quantities; (25) linear (feet) of <50 mm (2 inches) diameter pipe insulation and mudded elbows.

(160) linear (feet) of 50 - 150 mm (2 inches - 6 inches) diameter pipe insulation and mudded elbows.

C. Related Work:

1. Section 07 84 00, FIRESTOPPING
2. Section 02 41 00, DEMOLITION
3. Division 09, FINISHES
4. Division 22, PLUMBING
5. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
6. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING
7. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING
8. Section 22 11 00, FACILITY WATER DISTRIBUTION
9. Section 22 13 00, FACILITY SANITARY AND VENT PIPING SEWERAGE

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.

E. Contractors Use of Premises:

2. 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.
3. 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 COR; 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 COR. A stop asbestos removal order may be issued at any time the VA COR 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 COR as soon as practical. The Contractor shall

immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities if:

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

1.4 DEFINITIONS

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

B. Glossary:

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

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

Aerosol - Solid or liquid particulate suspended in air.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Encapsulation - Treating ACM with an encapsulant.

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

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

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

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

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

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

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

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

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

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

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

HVAC - Heating, Ventilation and Air Conditioning

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

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

inspection and clearance air sampling be licensed as an asbestos project monitor.

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

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

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

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

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

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

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

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

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

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

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

Permissible exposure limit (PEL) - The level of exposure OSHA allows for as an eight (8) hour time-weighted average (TWA). For asbestos

fibers, the eight (8) hour time-weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit (EL) is 1.0 fibers per cubic centimeter (1 f/cc).

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

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

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

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

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

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

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

Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a

minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH/CIH) or Contractor's PIH (CPIH/CIH).

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

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

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

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

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

Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.5 APPLICABLE CODES AND REGULATIONS

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

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

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

C. Federal Requirements:
1. Federal requirements which govern asbestos abatement include, but are not limited to, the following regulations:
a. Occupational Safety and Health Administration **(OSHA)**
1) Title 29 CFR 1926.1101 - Construction Standard for Asbestos
2) Title 29 CFR 1926 Subpart E - Personal Protective Equipment and Life Saving Equipment
3) Title 29 CFR 1910.134 - Respiratory Protection
4) Title 29 CFR 1926 - Construction Industry Standards
5) Title 29 CFR 1926.33 - Access to Employee Exposure and Medical Records
6) Title 29 CFR 1926.59 same as 1910.1200 - Hazard Communication
7) Title 29 CFR 1926 Subpart C – General Safety and Health Provisions and Subpart D – Occupational Health and Environmental Controls
b. Environmental Protection Agency **(EPA):**
1) 40 CFR 61 Subpart M - National Emission Standard for Hazardous Air Pollutants - Asbestos.
2) 40 CFR 763 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos Hazard Abatement Reauthorization Act (ASHARA)
c. Department of Transportation **(DOT)**
1) Title 49 CFR 171 - 180 – Transportation

D. State Requirements:
1. State requirements that apply to the asbestos abatement work, disposal, clearance, etc., include, but are not limited to, the following:

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

F. Standards:
1. Standards which govern asbestos abatement activities include, but are not limited to, the following:
a. American National Standards Institute (ANSI)/ASSP Z9.2-2018 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI/ASSE Z88.2-2015 - Practices for Respiratory Protection.

b. Underwriters Laboratories (UL) 586-2009 - UL Standard for Safety of HEPA Filter Units, 9th Edition; ANSI Approval 2017-12-19.

2. Standards which govern encapsulation work include, but are not limited to the following:
   a. American Society for Testing and Materials International (ASTM)
3. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
   a. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
   b. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
   c. NFPA 101 - Life Safety Code

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

H. Notices:
1. State and Local agencies: Send written notification as required by State and Local regulations prior to beginning any work on ACM as follows:
2. Copies of notifications shall be submitted to the VA for the facility's records in the same time frame notification are given to EPA, State, and Local authorities.

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

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 four (4) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.

3) The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have five (5) years of monitoring experience and supervision of asbestos abatement projects; has participated as senior IH on five (5) abatement projects,

three (3) of which are similar in size and complexity as this project; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.

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

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

1.7 RESPIRATORY PROTECTION

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

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

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

D. Minimum Respiratory Protection: Shall be a ½-mask negative pressure air purifying respirator equipped with P100 filters, provided personal air samples in the workplace remain at or below 0.1 f/cc, determined as an 8-hour TWA. Full face powered air purifying respirator equipped with P100 filters shall be required until Contractor demonstrates that personal air samples are at or below 0.1 f/cc, determined as an 8-hour TWA. A higher level of respiratory protection shall be required, if fiber levels exceed 1 f/cc as an 8-hour TWA, inside the regulated work area. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h) and 29 CFR 1910.134 (d)(3)(i)(A) Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

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

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

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

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

I. Supplied Air Systems: If a supplied air system is used, the system shall meet all requirements of 29 CFR 1910.134 and the ANSI/Compressed Gas Association (CGA) Commodity Specification for Air current requirements for Type 1 - Grade D breathing air. Low pressure systems

are not allowed to be used on asbestos abatement projects. Supplied Air respirator use shall be in accordance with EPA/NIOSH publication EPA-560-OPTS-86-001 "A Guide to Respiratory Protection for the Asbestos Abatement Industry". The competent person on site will be responsible for the supplied air system to ensure the safety of the worker.

1.8 WORKER PROTECTION

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

B. Medical Examinations: Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion that the person has been evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

C. Regulated Area Entry Procedure: The Competent Person shall ensure that each time workers enter the regulated area; they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

D. Decontamination Procedure: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.

1. When exiting the regulated area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.
2. Still wearing the respirator and completely naked, proceed to the shower. Showering is MANDATORY. Care must be taken to follow

reasonable procedures in removing the respirator to avoid inhaling asbestos fibers while showering. The following procedure is required as a minimum:

a. Thoroughly wet body including hair and face. If using a PAPR hold blower above head to keep filters dry.
b. With respirator still in place, thoroughly decontaminate body, hair, respirator face piece, and all other parts of the respirator except the blower and battery pack on a PAPR. Pay particular attention to cleaning the seal between the face and respirator facepiece and under the respirator straps.
c. Take a deep breath, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.

3. Carefully decontaminate the facepiece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) carefully decontaminate battery pack with a wet rag being cautious of getting water in the battery pack thus preventing destruction. **(THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!)**
4. Shower and wash body completely with soap and water. Rinse thoroughly.
5. Rinse shower room walls and floor to drain prior to exiting.
6. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

E. Regulated Area Requirements: The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for regulated areas at 29 CFR 1926.1101 (e) are met. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

A. Description: Provide each regulated area with separate personnel decontamination facilities (PDF) and waste/equipment decontamination

facilities (W/EDF). Ensure that the PDF are the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the W/EDF.

B. General Requirements: All personnel entering or exiting a regulated area must go through the PDF and shall follow the requirements at 29 CFR 1926.1101 (j)(1) and these specifications. All waste, equipment and contaminated materials must exit the regulated area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF must be constructed of a minimum of 3 layers of 6-mil opaque fire retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 3 layers of 6-mil poly shall also be used to cover the floor under the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape or approved equivalent so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

C. Temporary Facilities to the PDF and W/EDF: The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention must be provided at the point of connection to the VA system. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141(d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel equipped with GFCI protection for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50 foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70 degrees F throughout the PDF and W/EDF.

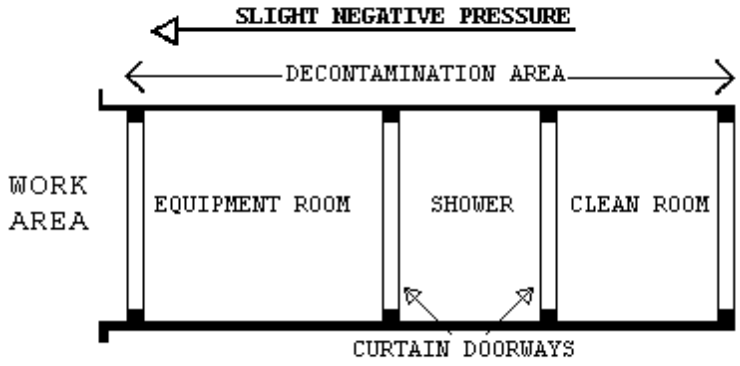
D. Personnel Decontamination Facility (PDF): The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room which is connected to the regulated area. The PDF must be sized to accommodate the number of personnel scheduled for the project. The shower room, located in the center of the PDF, shall be fitted with as many portable showers as necessary to insure all employees can complete the entire decontamination procedure within 15

minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.

1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3 layers of 6-mil opaque fire retardant poly to provide an air tight room. Provide a minimum of 2 - 900 mm (3 foot) wide 6-mil poly opaque fire retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry and sanitary condition. Shower overflow shall not be allowed into the clean room. Provide 1 storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Male/Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male/female can enter or exit the PDF during his/her stay in the PDF.
2. Shower Room: The Competent Person shall assure that the shower room is a completely water tight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using air tight walls made from at least 3 layers of 6-mil opaque fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an

individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Waste water will be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters will be changed a minimum of daily or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste.

3. Equipment Room: The Competent Person shall provide an equipment room which shall be an air tight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The Competent Person shall ensure that most gross contamination is removed from the outside of PPE, suits and respirators in the regulated work area, prior to entering the Equipment Room. The equipment room shall be separated from the regulated area by a minimum 3 foot wide door made with 2 layers of 6-mil opaque fire retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by air tight walls and ceiling constructed of a minimum of 3 layers of 6-mil opaque fire retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6-mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area.
4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of 2 layers of 6-mil opaque fire retardant poly.



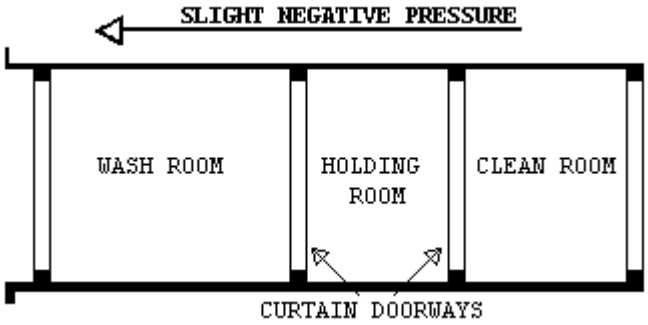
E. Waste/Equipment Decontamination Facility (W/EDF):

1. The Competent Person shall provide a W/EDF consisting of a wash room, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:
   a. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Wash Room as an equipment bag and container cleaning station.
   b. Wash Room: Provide a wash room for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the wash room using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and 3 layers of 6-mil fire retardant poly. Locate the wash room so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the wash room shall be constructed of 2 layers of 6-mil fire retardant poly.
   c. Holding Room: Provide a holding room as a drop location for bagged materials passed from the wash room. Construct the holding room using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and 3 layers of 6-mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the wash room to the clean room unless it goes

through the holding room. Doorways in the holding room shall be constructed of 2 layers of 6-mil fire retardant poly.

d. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 inches x 4 inches wood framing or approved equivalent and 2 layers of 6-mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of 2 layers of 6-mil fire retardant poly. When a negative pressure differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.

e. The W/EDF shall be as follows: Wash Room leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



F. Waste/Equipment Decontamination Procedures: At the washdown station in the regulated area, thoroughly wet clean contaminated equipment and/or sealed polyethylene bags and pass into Wash Room after visual inspection. When passing anything into the Wash Room, close all doorways of the W/EDF, other than the doorway between the washdown station and the Wash Room. Keep all outside personnel clear of the W/EDF. Once inside the Wash Room, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. At no time shall personnel from the clean side be allowed to enter the Wash Room.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. General Requirements: Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's representative.

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mils. For floors and all other uses, sheeting of at least 6-mil shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
6. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape, poly tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or approved equivalent procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
7. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6-mil fire retardant poly.

8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.
9. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
10. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
11. Disposal bags – 2 layers of 6-mil poly for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
12. The VA shall be provided an advance copy of the Safety Data Sheets (SDS) as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-start meeting submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
13. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.
14. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

2.2 MONITORING, INSPECTION AND TESTING

A. General:

1. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the employee exposure to asbestos must not exceed 0.1 fiber per cubic

centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples inside the building, but outside the regulated area. Inside the building, but outside the regulated area air samples shall be collected in the Clean Room of the PDF, at the approximate location of HEPA exhaust discharge, and at a minimum of three (3) locations in areas immediately outside the regulated work area to satisfy this specification. Additional inspection and testing requirements are also indicated in other parts of this specification.

2. The VA will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the VA except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results. Any repeated final inspections and/or testing, if required, will be paid for by the Contractor.
3. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation

of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH/CIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's representative.

B. Scope of Services of the VPIH/CIH Consultant:

1. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the regulated area; and assure clearance at the end of the project. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:
   a. Task 1: Establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
   b. Task 2: Perform representative air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
   c. Task 3: Perform unannounced visits to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.

d. Task 4: Provide support to the VA representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.
e. Task 5: Perform, in the presence of the VA representative, final inspection and testing of a decontaminated regulated area at the conclusion of the abatement to certify compliance with all regulations and VA requirements/specifications.
f. Task 6: Issue certificate of decontamination for each regulated area and project report.

2. All documentation, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.
3. The monitoring and inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

C. Monitoring, Inspection and Testing by Contractor CPIH/CIH: The Contractor’s CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor’s personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH Technician shall have successfully completed a NIOSH 582 Course or equivalent and provide documentation. The IH Technician shall participate in the AIHA Asbestos Analysis Registry or participate in the Proficiency Analytical Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and

area samples and have experience in substantially similar projects in size and scope. The analytical laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT and approved by the VA prior to start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for personal and area air monitoring for asbestos in 29 CFR 1926.1101(f), (g) and Appendix A. This log shall be made available to the VA representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. No fewer than two (2) personal air samples or 25 percent of representative workforce per shift shall be collected, whichever is greater, in the regulated area; a minimum of three (3) area air samples at locations inside the building but immediately outside the regulated work area; one (1) area air sample shall be collected daily in the Clean Room of the PDF; and one (1) area air sample shall be collected daily at the approximate location of HEPA exhaust discharge. In addition to the continuous monitoring required, the CPIH/CIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities. Additionally, the CPIH/CIH will monitor and record pressure readings within the containment daily with a minimum of two readings at the beginning and at the end of a shift, and submit the data in the daily report.

2.3 ASBESTOS HAZARD ABATEMENT PLAN

A. The Contractor shall have an established an Asbestos Hazard Abatement Plan (AHAP) in printed form and loose leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the procedures to be followed during all phases of the work by the Contractor's personnel. The AHAP must be modified as needed to address specific requirements of this project and the specifications. The AHAP shall be submitted for review and approval to the VA prior to the start of any abatement work. The minimum topics and areas to be covered by the AHAPs are:

1. Minimum Personnel Qualifications
2. Emergency Action Plan/Contingency Plans and Arrangements
3. Security and Safety Procedures
4. Respiratory Protection/Personal Protective Equipment Program and Training
5. Medical Surveillance Program and Recordkeeping
6. Regulated Area Requirements - Containment Barriers/Isolation of Regulated Area
7. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF)
8. Negative Pressure Systems Requirements
9. Monitoring, Inspections, and Testing
10. Removal Procedures for ACM
11. Removal of Contaminated Soil (if applicable)
12. Encapsulation Procedures for ACM
13. Disposal of ACM waste/equipment
14. Regulated Area Decontamination/Clean-up
15. Regulated Area Visual and Air Clearance
16. Project Completion/Closeout

2.4 SUBMITTALS

A. Pre-Start Meeting Submittals:

1. Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:
   a. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
   b. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
   c. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.
   d. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers,

performance characteristics, pictures/diagrams, and number available for the following:

1) Supplied air system, negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
2) Waste water filtration system, shower system, containment barriers.
3) Encapsulants, surfactants, hand held sprayers, airless sprayers, glovebags, and fire extinguishers.
4) Respirators, protective clothing, fall protection and other required personal protective equipment.
5) Fire safety equipment to be used in the regulated area.

e. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
f. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.
g. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. Area or clearance air monitoring shall be conducted in accordance with EPA AHERA protocols.
h. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.
    1) Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; Completion Date

2) List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution
3) List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal and state EPA), penalties, and legal actions taken against the company including the company's officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.

i. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulation. Submit the phone number and doctor/clinic/hospital used for medical evaluations.
1) CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; medical opinion; and current respirator fit test.
2) Competent Person(s)/Supervisor(s): Number; names; last four digits of social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.
3) Workers: Numbers; names; last four digits of social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion

(asbestos surveillance and respirator use); and current respirator fit test.

j. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of AHAPs incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and standard operating procedures; and copies of monitoring results of the five referenced projects listed and analytical methods used.

k. Rented equipment must be decontaminated prior to returning to the rental agency.

l. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all SDS and application instructions.

B. Submittals During Abatement:

1. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; and representative air monitoring and results/TWA's/EL's. Submit this information daily to the VA's representative.

2. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.

a. Removal of any poly barriers.

b. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant.

c. Packaging and removal of ACM waste from regulated area.

d. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's representative on a weekly basis.

C. Submittals at Completion of Abatement: The CPIH/CIH shall submit a project report consisting of the daily log book requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area samples must be submitted. The VA representative will retain the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

2.5 ENCAPSULANTS

A. Types of Encapsulants:

1. The following four types of encapsulants, if used, must comply with performance requirements as stated in paragraph 2.5.2:
   a. Removal encapsulant - used as a wetting agent to remove ACM.
   b. Bridging encapsulant - provides a tough, durable coating on ACM.
   c. Penetrating encapsulant - penetrates/encapsulates ACM at least 13 mm (1/2 inches).
   d. Lockdown encapsulant - seals microscopic fibers on surfaces after ACM removal.

B. Performance Requirements:

1. Encapsulants shall meet the latest requirements of EPA; shall not contain toxic or hazardous substances; or solvents; and shall comply with the following performance requirements:
   a. General Requirements for all Encapsulants:
      1) ASTM E84: Flame spread of 25; smoke emission of 50.
      2) University of Pittsburgh Protocol: Combustion Toxicity; zero mortality.
      3) ASTM C732: Accelerated Aging Test; Life Expectancy - 20 years.
      4) ASTM E96: Permeability - minimum of 0.4 perms.

b. Bridging/Penetrating Encapsulants:

1) ASTM E736: Cohesion/Adhesion Test - 24 kPa (50 pounds/square foot).
2) ASTM E119: Fire Resistance - 3 hours (Classified by UL for use on fibrous/cementitious fireproofing).
3) ASTM D2794: Gardner Impact Test; Impact Resistance - minimum 11.5 kg-mm (43 in/lb).
4) ASTM D522: Mandrel Bend Test; Flexibility - no rupture or cracking.

c. Lockdown Encapsulants:

1) ASTM E119: Fire resistance - 3 hours (tested with fireproofing over encapsulant applied directly to steel member).
2) ASTM E736: Bond Strength - 48 kPa (100 pounds/square foot) (test compatibility with cementitious and fibrous fireproofing).
3) In certain situations, encapsulants may have to be applied to hot pipes/equipment. The encapsulant must be able to withstand high temperatures without cracking or creating any noxious gaseous or vapors during or after application.

C. Certificates of Compliance: The Contractor shall submit to the VA representative certification from the manufacturer indicating compliance with performance requirements for encapsulants when applied according to manufacturer recommendations.

PART 3 - EXECUTION

3.1 REGULATED AREA PREPARATIONS

A. Site Security:

1. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and representatives, State and Local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and be posted in the clean room of the decontamination unit.
2. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent Person shall immediately require any

unauthorized person to leave the regulated area and then notify the VA COR or VA Representative using the most expeditious means.

3. A log book shall be maintained in the clean room of the decontamination unit. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.
4. Access to the regulated area shall be through a single decontamination unit. All other access (doors, windows, hallways, etc.) shall be sealed and demarcated as an asbestos regulated work area to prevent entry to or exit from the regulated area unless in the event of an emergency. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall not be locked from the inside; however, they shall be sealed with poly sheeting and taped until needed. In any situation where exposure to high temperatures which may result in a flame hazard, fire retardant poly sheeting must be used.
5. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24-hour security system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.
6. The Contractor will have the VA's assistance in notifying adjacent personnel of the presence, location and quantity of ACM in the regulated area and enforcement of restricted access by the VA's employees.
7. The regulated area shall be locked during non-working hours and secured by VA Representative or Competent Person. The VA Police shall be informed of asbestos abatement regulated areas to provide security checks during facility rounds and emergency response.

B. Signage and Power Management:

1. Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and

take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.

2. Shut down and lock out/tag out electric power to the regulated area. Provide temporary power and lighting. Insure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.
3. Shut down and lock out/tag out heating, cooling, and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Investigate the regulated area and agree on pre-abatement condition with the VA's representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2 layers of independently installed 6-mil poly. Also, seal any seams in system components that pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil polyethylene disposal bags for staging and eventual disposal as asbestos waste.

C. Negative Pressure Filtration System:

1. The Contractor shall provide enough HEPA negative air machines to effect $\geq$ - 0.02 inch WCG pressure differential inside the regulated work area. The Competent Person shall determine the number of units needed for the regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to effect $\geq$ - 0.02 inch WCG pressure inside the regulated work area. Provide standby units in the event of machine failure and/or emergency in an adjacent area. HEPA equipped negative air machines shall be discharged outside of the building a minimum of 30 feet from building make-up air, doors, open windows, patients, visitors and staff.
2. NIOSH has done extensive studies and has determined that negative air machines typically operate at ~50 percent efficiency. The contractor shall consider this in their determination of number of units needed to provide $\geq$ - 0.02 inch WCG pressure differential inside the regulated work area. The contractor shall use double the number of machines, based on their calculations, or submit proof

their machines operate at stated capacities, at a 2 inches pressure drop across the filters.

3. Design and Layout:
   a. Before start of work submit the design and layout of the regulated area and the negative air machines. The submittal shall indicate the number of, location of and size of negative air machines. The point(s) of exhaust, air flow within the regulated area, anticipated negative pressure differential, and supporting calculations for sizing shall be provided. In addition, submit the following:
      1) Method of supplying power to the units and designation/location of the panels.
      2) Description of testing method(s) for correct air volume and pressure differential.
      3) If auxiliary power supply is to be provided for the negative air machines, provide a schematic diagram of the power supply and manufacturer's data on the generator and switch.
4. Negative Air Machines (Hepa Units):
   a. Negative Air Machine Cabinet: The cabinet shall be constructed of steel or other durable material capable of withstanding potential damage from rough handling and transportation. The width of the cabinet shall be less than 30 inches in order to fit in standard doorways. The cabinet must be factory sealed to prevent asbestos fibers from being released during use, transport, or maintenance. Any access to and replacement of filters shall be from the inlet end. The unit must be on casters or wheels.
   b. Negative Air Machine Fan: The rating capacity of the fan must indicate the CFM under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan must be a centrifugal type fan.
   c. Negative Air Machine Final Filter: The final filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an air tight seal. Each HEPA filter shall be certified by the manufacturer to have an efficiency of not

less than 99.97 percent. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter must bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.

d. Negative Air Machine Pre-filters: The pre-filters, which protect the final HEPA filter by removing larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. A first stage pre-filter shall be a low efficiency type for particles 10 µm or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5 µm or larger. Pre-filters shall be installed either on or in the intake opening of the NAM and the second stage filter must be held in place with a special housing or clamps.
e. Negative Air Machine Instrumentation: Each unit must be equipped with a gauge to measure the pressure drop across the filters and to indicate when filters have become loaded and need to be changed. A table indicating the cfm for various pressure readings on the gauge shall be affixed near the gauge for reference or the reading shall indicate at what point the filters shall be changed, noting cfm delivery. The unit must have an elapsed time meter to show total hours of operation.
f. Negative Air Machine Safety and Warning Devices: An electrical/ mechanical lockout must be provided to prevent the fan from being operated without a HEPA filter. Units must be equipped with an automatic shutdown device to stop the fan in the event of a rupture in the HEPA filter or blockage in the discharge of the fan. Warning lights are required to indicate normal operation; too high a pressure drop across filters; or too low of a pressure drop across filters.
g. Negative Air Machine Electrical: All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriters Laboratories (UL). Each unit must be provided with overload protection and the motor, fan, fan housing, and cabinet must be grounded.

h. It is essential that replacement HEPA filters be tested using an "in-line" testing method, to ensure the seal around the periphery was not damaged during replacement. Damage to the outer HEPA filter seal could allow contaminated air to bypass the HEPA filter and be discharged to an inappropriate location. Contractor will provide written documentation of test results for negative air machine units with HEPA filters.

5. Pressure Differential: The fully operational negative air system within the regulated area shall continuously maintain a pressure differential $\geq$ - 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 $\geq$ - 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 COR, verbally and in writing.
c. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.
d. Abatement work shall begin at a location farthest from the units and proceed towards them. If an electric failure occurs, the Competent Person shall stop all abatement work and immediately begin wetting all exposed asbestos materials for the duration of the power outage. Abatement work shall not resume until power is restored and all units are operating properly again.
e. The negative air machines shall continue to run after all work is completed and until a final visual clearance and a final air clearance has been successfully completed for that regulated area.

12. Dismantling The System: After completion of the final visual and final air clearance has been obtained by the VPIH/CIH, the units may be shut down. The unit exterior surfaces shall have been completely decontaminated; pre-filters are not to be removed and the units inlet/outlet sealed with 2 layers of 6-mil poly immediately after shut down. No filter removal shall occur at the VA site following successful completion of site clearance. OSHA/EPA/DOT asbestos labels shall be attached to the units.

D. Containment Barriers and Coverings in the Regulated Area:
1. General: Seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area must be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated as a result of the work, Contractor shall immediately stop work and clean up the contamination at no additional cost to the VA. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 3.1.4.8; FIRESTOPPING.
2. Preparation Prior To Sealing: The Regulated Area: Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All

uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects not scheduled for removal remaining in the regulated area shall be completely covered with 2 layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area.

3. Controlling Access to The Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF). All other means of access shall be eliminated and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to, or within view of an occupied area, provide a visual barrier of 6-mil opaque fire retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.
4. Critical Barriers: Completely separate any operations in the regulated area from adjacent areas using 2 layers of 6-mil fire retardant poly and duct tape. Individually seal with 2 layers of 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.
5. Primary Barriers:
   a. Cover the regulated area with two layers of 6-mil fire retardant poly on the floors and two layers of 4 mil, fire retardant poly on the walls, unless otherwise directed in writing by the VA representative. Floor layers must form a right angle with the wall and turn up the wall at least 300 mm (12 inches). Seams must overlap at least 1800 mm (6 feet) and must be spray glued and taped. Install sheeting so that layers can be removed independently from each other. Carpeting shall be covered with three layers of 6-mil poly. Corrugated cardboard sheets must be placed between the bottom and middle layers of poly. Mechanically support and seal with duct tape and glue all wall layers.
   b. If stairs and ramps are covered with 6-mil plastic, two layers must be used. Provide 19 mm (3/4 inch) exterior grade plywood

treads held in place with duct tape/glue on the plastic. Do not cover rungs or rails with any isolation materials.

6. Secondary Barriers: A loose layer of 6-mil shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced as needed during the work.
7. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. Decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.
8. Firestopping:
   a. Through penetrations caused by cables, cable trays, pipes, sleeves, conduits, etc. must be firestopped with a fire-rated firestop system providing an air tight seal.
   b. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.
   c. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed.

E. Sanitary Facilities: The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.

F. Personal Protective Equipment: Provide whole body clothing, head coverings, gloves and foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the

project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

G. Pre-Cleaning:

1. The VA will provide water for abatement purposes. The Contractor shall connect to the existing VA system. The service to the shower(s) shall be supplied with backflow prevention.
2. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. All workers performing pre-cleaning activities must don appropriate personal protective equipment (PPE), as specified throughout this document and as approved in the Contractor’s work plan. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.
3. Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location. Drapes, clothing, upholstered furniture and other fabric items shall be disposed of as asbestos contaminated waste. Cleaning these asbestos contaminated items utilizing HEPA vacuum techniques and off-premises steam cleaning is very difficult and cannot guarantee decontamination. Carpeting will be disposed of prior to abatement if in the regulated area. If ACM floor tile is attached to the carpet while the Contractor is removing the carpet that section of the carpet will be disposed of as asbestos waste.
4. Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums and/or wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with 2 layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must remain in the regulated area and that require special ventilation or

enclosure requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.

5. Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos-containing materials during this pre-cleaning phase.

H. Pre-Abatement Activities:

1. Pre-Abatement Meeting: The VA representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH/CIH that all materials and equipment required for the project are on the site, will arrange for a pre-abatement meeting between the Contractor, the CPIH/CIH, Competent Person(s), the VA representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/documentation to the VA's representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.
2. Pre-Abatement Construction and Operations:
   a. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
   b. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's representative when the work is completed in accordance with this specification. The VA's representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP(s), especially worker protection, respiratory systems, contingency plans,

decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for respiratory protection and the negative pressure system shall be demonstrated for proper performance.

c. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's representative.

d. Upon satisfactory inspection of the installation of and operation of systems, the VA's representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification and all applicable regulations.

3. Pre-Abatement Inspections and Preparations:

a. Before any work begins on the construction of the regulated area, the Contractor will:

1) Conduct a space-by-space inspection with an authorized VA representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.

2) A NESHAP (destructive) ACM inspection shall be conducted on all building structures that will be demolished. Ensure the following areas are inspected on the project: lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside utility chases/walls; transite piping/ductwork/sheets; behind radiators; lab fume hoods; transite lab countertops; roofing materials; below window sills; water/sewer lines; electrical conduit coverings; crawlspaces (previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; and steam line trench coverings. Verify during NESHAP survey that no other suspect ACM is present.

3) Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination.

4) If present and required, remove and dispose of carpeting from floors in the regulated area.
5) Inspect existing firestopping in the regulated area. Correct as needed.

3.2 REMOVAL OF ACM

A. Wetting ACM:

1. Use amended water for the wetting of ACM prior to removal. The Competent Person shall assure the wetting of ACM meets the definition of "adequately wet" in the EPA NESHAP regulation and OSHA’s “wet methods” for the duration of the project. A removal encapsulant may be used instead of amended water with written approval of the VA's representative.
2. Amended Water: Provide water to which a surfactant has been added to wet the ACM and reduce the potential for fiber release during disturbance of ACM. The mixture must be equal to or greater than the wetting provided by water amended by a surfactant consisting of one ounce of 50 percent polyoxyethylene ester and 50 percent polyoxyethylene ether mixed with 5 gallons (19L) of water.
3. Removal Encapsulant: When authorized by VA, provide a removal encapsulant designed specifically for the removal of ACM. The material must, when used, result in adequate wetting of the ACM and retard fiber release during removal.

B. Secondary Barrier and Walkways:

1. Install as a drop cloth a 6-mil poly sheet at the beginning of each work shift where removal is to be done during that shift. Completely cover floors and any walls within 10 feet (3 meters) of the area where work is to done. Secure the secondary barrier with duct tape to prevent it from moving or debris from getting behind it. Remove the secondary barrier at the end of the shift or as work in the area is completed. Keep residue on the secondary barrier wetted. When removing, fold inward to prevent spillage and place in a disposal bag.
2. Install walkways using 6-mil black poly between the regulated area and the decontamination facilities (PDF and W/EDF) to protect the primary layers from contamination and damage. Install the walkways at the beginning of each shift and remove at the end of each shift.

C. Wet Removal of ACM:

1. Adequately and thoroughly wet the ACM to be removed prior to removal with amended water or when authorized by VA, removal encapsulant to reduce/prevent fiber release to the air. Adequate time must be allowed for the amended water or removal encapsulant to saturate the ACM. Abatement personnel must not disturb dry ACM. Use a fine spray of amended water or removal encapsulant. Saturate the material sufficiently to wet to the substrate without causing excessive dripping. The material must be sprayed repeatedly/continuously during the removal process in order to maintain adequately wet conditions. Removal encapsulants must be applied in accordance with the manufacturer's written instructions. Perforate or carefully separate, using wet methods, an outer covering that is painted or jacketed in order to allow penetration and wetting of the material. Where necessary, carefully remove covering while wetting to minimize fiber release. **In no event shall dry removal occur except when authorized in writing by the VPIH/CIH and VA when a greater safety hazard (e.g., electricity) is present.**
2. If ACM does not wet well with amended water due to composition, coating or jacketing, remove as follows:
   a. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.
   b. Remove saturated ACM in small sections. Do not allow material to dry out. As material is removed, bag material, while still wet into disposal bags. Twist the bag neck tightly, bend over (gooseneck) and seal with a minimum of three tight wraps of duct tape. Clean /decontaminate the outside of the bag of any residue and move to washdown station adjacent to W/EDF.
   c. 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 COR. Insure 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 and VA Representative, the VPIH/CIH will perform the final clearance

testing. Air samples will be collected and analyzed in accordance with procedures for AHERA in this specification. If work is less than 260 lf/160 sf/35 cf, 5 PCM samples shall be collected for clearance and a minimum of two field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA presented in this specification. If the release criteria are not met, the Contractor shall repeat the final cleaning and continue decontamination procedures until clearance is achieved. **All Additional inspection and testing costs will be borne by the Contractor.**

2. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

D. Final Air Clearance Procedures:

1. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured by the AHERA PCM protocol and < 70 AHERA asbestos structures per square millimeter (s/mm2) by AHERA TEM. No averaging of results will be used for this project. All five (5) TEM samples inside the regulated area shall be at or below 70 asbestos s/mm2 to satisfy the project final clearance criteria.
2. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures:
   a. Fibers Counted: “Fibers” referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.
   b. Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques except where soil is not encapsulated or enclosed. Samples will be collected on 0.8µ 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.

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 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. 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.

ATTACHMENT #1
CERTIFICATE OF COMPLETION

DATE: _____ VA Project #: _____

PROJECT NAME: _____ Abatement Contractor: _____

VAMC/ADDRESS: _____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):
   which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer’s recommendations.

CPIH/CIH Signature/Date: _____

CPIH/CIH Print Name: _____

Abatement Contractor Signature/Date: _____

Abatement Contractor Print Name: _____

ATTACHMENT #2
CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME: _____ DATE: _____

PROJECT ADDRESS: _____

ABATEMENT CONTRACTOR'S NAME: _____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate of worker's acknowledgement you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32-hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

- Physical Characteristics and Background Information on Asbestos
- Potential Health Effects Related to Exposure to Asbestos
- Employee Personal Protective Equipment
- Establishment of a Respiratory Protection Program
- State of the Art Work Practices
- Personal Hygiene
- Additional Safety Hazards
- Medical Monitoring
- Air Monitoring
- Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
- Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature: _____

Printed Name: _____

Social Security Number: _____

Witness: _____

ATTACHMENT #3
AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER: _____

VA MEDICAL FACILITY: _____

ABATEMENT CONTRACTOR'S NAME AND ADDRESS: _____

1. I verify that the following individual

Name: _____ Social Security Number: _____

who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.

Address: _____

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH: _____ Date: _____

Printed Name of CPIH/CIH: _____

Signature of Contractor: _____ Date: _____

Printed Name of Contractor: _____

ATTACHMENT #4
ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location:_____

VA Project #:_____

VA Project Description:_____

1. This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

2 I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

3. At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature_____Date_____

- - - 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 COR 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 COR 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 ACM piping and fittings and asbestos contaminated elements in an appropriate regulated area in the following approximate quantities:
   (25) linear (feet) of <50 mm (<2 inches) diameter pipe insulation and mudded elbows.

C. Related Work:

1. Section 07 84 00, FIRESTOPPING

2. Section 02 41 00, DEMOLITION
3. Division 09, FINISHES
4. Division 22, PLUMBING
5. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
6. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING
7. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING
8. Section 22 11 00, FACILITY WATER DISTRIBUTION
9. Section 22 13 00, FACILITY SANITARY SEWERAGE

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.

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 COR; 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 COR. A stop asbestos removal order may be issued at any time the VA COR 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 COR as soon as practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities if:

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

1.4 DEFINITIONS

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

B. Glossary:

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

Aerosol - Solid or liquid particulate suspended in air.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Encapsulation - Treating ACM with an encapsulant.

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

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

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

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

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

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

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

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

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

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

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

HVAC - Heating, Ventilation and Air Conditioning

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

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

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

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

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

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

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

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

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

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

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

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

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

Permissible exposure limit (PEL) - The level of exposure OSHA allows for an 8-hour time weighted average. For asbestos fibers, the eight (8) hour time-weighted average PEL is 0.1 fibers per cubic centimeter (0.1

f/cc) of air and the 30-minute Excursion Limit (EL) is 1.0 fibers per cubic centimeter (1 f/cc).

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

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

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

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

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

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

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

Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of

which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH/CIH) or Contractor's PIH (CPIH/CIH).

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

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

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

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

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

Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.5 APPLICABLE CODES AND REGULATIONS

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

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

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

C. Federal Requirements: Federal requirements which govern some aspect of asbestos abatement include, but are not limited to, the following regulations.
   1. Occupational Safety and Health Administration **(OSHA)**
      a. Title 29 CFR 1926.1101 - Construction Standard for Asbestos
      b. Title 29 CFR 1926 Subpart E - Personal Protective Equipment and Life Saving Equipment
      c. Title 29 CFR 1910.134 - Respiratory Protection
      d. Title 29 CFR 1926 - Construction Industry Standards
      e. Title 29 CFR 1926.33 - Access to Employee Exposure and Medical Records
      f. Title 29 CFR 1926.59 same as 1910.1200 - Hazard Communication
      g. Title 29 CFR 1926 Subpart C – General Safety and Health Provisions and Subpart D – Occupational Health and Environmental Controls
   2. Environmental Protection Agency **(EPA)**
      a. 1.40 CFR 61 Subpart M - National Emission Standard for Hazardous Air Pollutants - Asbestos
      b. 2.40 CFR 763.80 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos Hazard Abatement Reauthorization Act (ASHARA)
   3. Department of Transportation **(DOT)**
      a. Title 49 CFR 171 - 180 – Transportation

D. State Requirements:
   1. State requirements that apply to the asbestos abatement work, disposal, clearance, etc., include, but are not limited to, the following:

E. Local Requirements:
   1. If Local requirements are more stringent than Federal or State standards, the local standards are to be followed.

F. Standards:
   1. Standards which govern asbestos abatement activities include, but are not limited to, the following:
      a. American National Standards Institute (ANSI/ASSP) Z9.2-2018 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI/ASSE Z88.2-2015 - Practices for Respiratory Protection.

b. Underwriters Laboratories (UL) 586-2009 - UL Standard for Safety of HEPA filter Units, 9th Edition; ANSI Approval 2017-12-19.

2. Standards which govern encapsulation work include, but are not limited to, the following:
   a. American Society for Testing and Materials International (ASTM).
3. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
   a. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
   b. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
   c. NFPA 101 - Life Safety Code.

G. EPA Guidance Documents:
1. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference. 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:
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.
   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.

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:
   a. Proof of Contractor licensing.

b. Proof the Competent Person is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person shall also be presented.
c. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
d. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.
e. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.1101 (m).
f. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.
g. 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 four (4) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.

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

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

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

1.7 RESPIRATORY PROTECTION

A. General - Respiratory Protection Program: The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.134. ANSI Standard Z88.2-2015 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c) - Respiratory Protection Program.Respiratory Protection Program Coordinator: The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years of experience coordinating RPP of similar size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

B. Selection and Use of Respirators: The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly

enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit or in the onsite Contractor's office, for reference by employees or authorized visitors.

C. Minimum Respiratory Protection: Minimum respiratory protection shall be a ½-mask negative pressure air purifying respirator equipped with P100 filters, provided personal air samples in the workplace remain at or below 0.1 f/cc, determined as an 8-hour TWA. Full face powered air purifying respirator equipped with P100 filters shall be required until Contractor demonstrates that personal air samples are at or below 0.1 f/cc, determined as an 8-hour TWA. A higher level of respiratory protection shall be required, if fiber levels exceed 1 f/cc as an 8-hour TWA, inside the regulated work area. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h) and 29 CFR 1910.134 (d)(3)(i)(A) Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

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

E. Respirator Fit Test: All personnel wearing respirators shall have a current quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Fit tests shall be done for PAPR's which have been put into a failure mode.

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

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

1.8 WORKER PROTECTION

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

B. Medical Examinations: Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion that the person has been evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

C. Personal Protective Equipment: Provide whole body clothing, head coverings, foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

D. Regulated Area Entry Procedure: The Competent Person shall ensure that each time workers enter the regulated area; they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment

E. Decontamination Procedure: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.

1. When exiting the regulated area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.

2. Still wearing the respirator and completely naked, proceed to the shower. Showering is MANDATORY. Care must be taken to follow reasonable procedures in removing the respirator to avoid inhaling asbestos fibers while showering. The following procedure is required as a minimum:
   a. Thoroughly wet body including hair and face. If using a PAPR hold blower above head to keep filters dry.
   b. With respirator still in place, thoroughly decontaminate body, hair, respirator face piece, and all other parts of the respirator except the blower and battery pack on a PAPR. Pay particular attention to cleaning the seal between the face and respirator facepiece and under the respirator straps.
   c. Take a deep breath, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.
3. Carefully decontaminate the facepiece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) carefully decontaminate battery pack with a wet rag being cautious of getting water in the battery pack thus preventing destruction. **(THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!)**
4. Shower and wash body completely with soap and water. Rinse thoroughly.
5. Rinse shower room walls and floor to drain prior to exiting.
6. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

F. Regulated Area Requirements: The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for Class I Glovebag regulated areas at 29 CFR 1926.1101 (e), 29 CFR 1926.1101 (g)(1)(i)(ii)(iii), 29 CFR 1926.1101 (g)(5)(ii)(iii)(iv) are met. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

A. Description: Provide each regulated area with separate personnel decontamination facilities (PDF) and waste/equipment decontamination facilities (W/EDF). Ensure that the PDF are the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the W/EDF.

B. General Requirements: All personnel entering or exiting a regulated area must go through the PDF and shall follow the requirements at 29 CFR 1926.1101 (j)(1) and these specifications. All waste, equipment and contaminated materials must exit the regulated area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF must be constructed of a minimum of 3-layers of 6-mil opaque fire retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 3-layers of 6-mil poly shall also be used to cover the floor under the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

C. Temporary Facilities to the PDF and W/EDF: The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention must be provided at the point of connection to the VA system. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141(d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel equipped with GFCI protection for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50 foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70˚F throughout the PDF and W/EDF.

D. Personnel Decontamination Facility (PDF): The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room. The PDF must be sized to accommodate the number of personnel scheduled for the project. The shower room, located

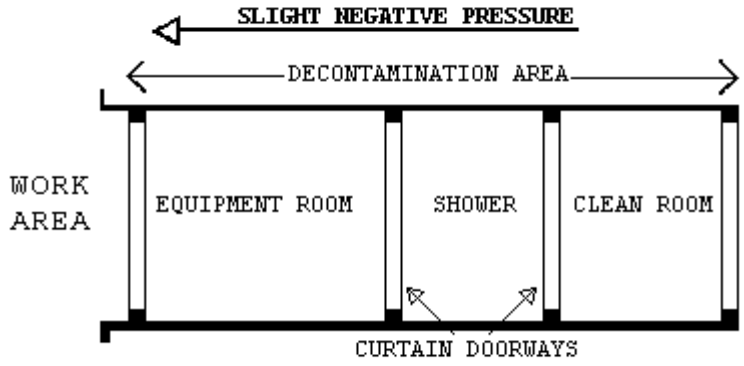
in the center of the PDF, shall be fitted with as many portable showers as necessary to insure all employees can complete the entire decontamination procedure within 15 minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.

1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3—layers of 6-mil opaque fire retardant poly to provide an air tight room. Provide a minimum of 2 - 900 mm (3 foot) wide 6-mil poly opaque fire retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry and sanitary condition. Shower overflow shall not be allowed into the clean room. Provide 1 storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Any person entering the regulated area to perform Glovebag removal work, in which a negative exposure assessment has been performed, shall don a double outer protective suit and respirator. Male/Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male/female can enter or exit the PDF during his/her stay in the PDF.
2. Shower Room: The Competent Person shall assure that the shower room is a completely water tight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and

equipment room using air tight walls made from at least 3-layers of 6-mil opaque fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Waste water will be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters will be changed a minimum of once per day or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste. The Competent Person shall provide a decontamination area at the outer perimeter of the regulated work area where the employees will decontaminate the outer protective suit and respirator by wet wiping and HEPA vacuuming.

3. Equipment Room: The Competent Person shall provide an equipment room which shall be an air tight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The equipment room shall be separated from the regulated area by a minimum 3 foot wide door made with 2-layers of 6-mil opaque fire retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by air tight walls and ceiling constructed of a minimum of 3-layers of 6-mil opaque fire retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6-mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area. The Competent Person shall provide a decontamination area at the outer perimeter of the regulated work area where the employees will decontaminate the outer protective suit and respirator by wet wiping and HEPA vacuuming.

4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of 2-layers of 6-mil opaque fire retardant poly.



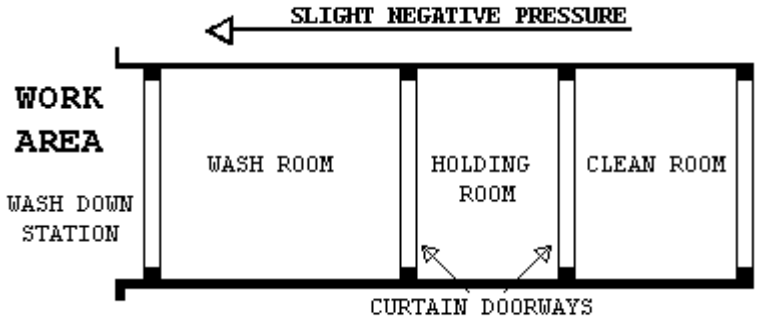
E. Waste/Equipment Decontamination Facility (W/EDF)

1. The Competent Person shall provide a W/EDF consisting of a wash room, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:
   a. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Wash Room as an equipment bag and container cleaning station.
   b. Wash Room: Provide a wash room for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the wash room using 50 x 100 mm (2 inches x 4 inches) wood framing and 3-layers of 6-mil fire retardant poly. Locate the wash room so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the wash room shall be constructed of 2-layers of 6-mil fire retardant poly.
   c. Holding Room: Provide a holding room as a drop location for bagged materials passed from the wash room. Construct the holding room using 50 x 100 mm (2 inches x 4 inches) wood framing or

approved equivalent and 3-layers of 6-mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the wash room to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of 2-layers of 6-mil fire retardant poly.

d. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 inches x 4 inches wood framing or approved equivalent and 2-layers of 6-mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of 2-layers of 6-mil fire retardant poly. When a negative pressure differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.

e. The W/EDF shall be as follows: Wash Room leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



F. Waste/Equipment Decontamination Procedures: At the washdown station in the regulated area, thoroughly wet wipe/clean contaminated equipment and/or sealed polyethylene bags and pass into Wash Room after visual inspection. When passing anything into the Wash Room, close all doorways of the W/EDF, other than the doorway between the washdown station and the Wash Room. Keep all outside personnel clear of the W/EDF. Once inside the Wash Room, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean

Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. At no time shall personnel from the clean side be allowed to enter the Wash Room.

PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT
2.1 MATERIALS AND EQUIPMENT

A. General Requirements (all abatement projects): Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's Representative.

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mils. For floors and all other uses, sheeting of at least 6-mils shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
6. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape, poly tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or approved equivalent procedures capable of sealing

polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.

7. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6-mil fire retardant poly.
8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.
9. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
10. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
11. Disposal bags – 2-layers of 6-mil poly for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
12. The VA shall be provided an advance copy of the Safety Data Sheets (SDS) as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-project submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
13. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal, State and Local regulations shall be posted in the Clean Room.
14. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d)

2.2 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA

A. General: Using critical barriers, seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All horizontal surfaces in the regulated area must be covered with 2-layers of 6-mil fire retardant poly to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated, immediately stop work and clean up the contamination at no additional cost to the Government. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 2.2.7; FIRESTOPPING.

B. Preparation Prior to Sealing the Regulated Area: Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. Remove all uncontaminated removable furniture, equipment and/or supplies from the regulated area before commencing work, or completely cover with 2-layers of 6-mil fire retardant poly sheeting and secure with duct tape. Lock out and tag out any HVAC systems in the regulated area.

C. Controlling Access to the Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF), if required. All other means of access shall be eliminated and OSHA Danger demarcation signs posted as required by OSHA. If the regulated area is adjacent to or within view of an occupied area, provide a visual barrier of 6-mil opaque fire retardant poly sheeting to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid.

D. Critical Barriers: Completely separate any openings into the regulated area from adjacent areas using fire retardant poly at least 6-mils thick and duct tape. Individually seal with 2-layers of independently installed 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects in the regulated area. Heat must be shut off any objects covered with poly.

E. Secondary Barriers: A loose layer of 6-mil fire retardant poly shall be used as a drop cloth to protect the floor/horizontal surfaces from debris generated during the Glovebag abatement. This layer shall be replaced as needed during the work.

F. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. If the affected area cannot be added to the regulated area, decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.

G. Firestopping:

1. Through penetrations caused by cables, cable trays, pipes, sleeves must be firestopped with a fire-rated firestop system providing an air tight seal.
2. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The Contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA Representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.
3. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed

2.3 MONITORING, INSPECTION AND TESTING

A. General:

1. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the employee exposure to asbestos must not exceed 0.1 fibers per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples inside the building, but outside the regulated area. Inside the building, but outside the regulated area air samples

shall be collected at the boundary of the regulated area and/or Clean Room of the PDF, at the approximate location of HEPA exhaust discharge (if used), and at a minimum of three (3) locations in areas immediately outside the regulated work area to satisfy this specification. Additional inspection and testing requirements are also indicated in other parts of this specification.

2. The VA will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the VA except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results. Any repeated final inspections and/or testing, if required, will be paid for by the Contractor.
3. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's Representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH/CIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples,

location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's Representative.

B. Scope of Services of the VPIH/CIH Consultant:

1. The purpose of the work of the VPIH/CIH is to: Assure quality; resolve problems; and prevent the spread of contamination beyond the regulated area. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:
   a. Task 1: Establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
   b. Task 2: Perform representative air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
   c. Task 3: Perform unannounced visits to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.
   d. Task 4: Provide support to the VA Representative such as evaluation of submittals from the Contractor, resolution of unforeseen developments, etc.
   e. Task 5: Perform, in the presence of the VA Representative, final inspection and testing of a decontaminated regulated area or building at the conclusion of the abatement and clean-up work to certify compliance with all regulations and the VA requirements/specifications.
   f. Task 6: Issue certificate of decontamination for each regulated area or building and project report.
2. All data, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and

consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.

3. The monitoring and inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.
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) Waste water filtration system, shower system, containment barriers.
      3) Encapsulantys, surfactants, hand held sprayers, airless sprayers, Glovebas, and fire extinguishers.

4) Respirators, water filtration system, shower system, containment barriers equipment.
5) Fire safety equipment to be used in the regulated area.

e. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
f. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.
g. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. Area or clearance air monitoring shall be conducted in accordance with EPA AHERA protocols.
h. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.
1) Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project; Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; and Completion Date.
2) List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; and Resolution.
3) List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal, State, Local NESHAP), penalties, and legal actions taken against the company including the company’s officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.

i. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulations. Submit the phone number and doctor/clinic/hospital used for medical evaluations.
   1) CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; medical opinion; and current respirator fit test.
   2) Competent Person(s)/Supervisor(s): Number; names; last four digits of social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.
   3) Workers: Numbers; names; last four digits of social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

j. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of AHAP(s) incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted; a list of

references of independent laboratories/IH's familiar with your air monitoring and Asbestos Hazard Abatement Plans; copies of monitoring results of the five referenced projects listed and analytical method(s) used.

k. Rented equipment must be decontaminated prior to returning to the rental agency.

l. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all SDS, and application instructions.

B. Submittals During Abatement:

1. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; representative air monitoring and results/TWAs/ELs. Submit this information daily to the VA's Representative.

2. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.

a. Removal of any poly barriers and/or failure of negative pressure Glovebags.

b. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant.

c. Packaging and removal of ACM waste from regulated area.

d. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's Representative on a weekly basis.

C. Submittals at Completion of Abatement: The CPIH/CIH shall submit a project report consisting of the daily log book requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area

samples must be submitted. The VA Representative will retain the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

2.6 ENCAPSULANTS

A. Types of Encapsulants:

1. The following four types of encapsulants must comply with performance requirements as stated in paragraph 2.6.2:
   a. Removal encapsulant - used as a wetting agent to remove ACM.
   b. Bridging encapsulant - provides a tough, durable coating on ACM.
   c. Penetrating encapsulant - penetrates/encapsulates ACM at least 13 mm (1/2 inch).
   d. Lockdown encapsulant - seals microscopic fibers on surfaces after ACM removal.

B. Performance Requirements:

1. Encapsulants shall meet the latest requirements of EPA; shall not contain toxic or hazardous substances; or solvents; and shall comply with the following performance requirements:
   a. General Requirements for all Encapsulants:
      1) ASTM E84: Flame spread of 25; smoke emission of 50.
      2) University of Pittsburgh Protocol: Combustion Toxicity; zero mortality.
      3) ASTM C732: Accelerated Aging Test; Life Expectancy - 20 years.
      4) ASTM E96: Permeability - minimum of 0.4 perms.
   b. Bridging/Penetrating Encapsulants:
      1) ASTM E736: Cohesion/Adhesion Test - 24 kPa (50 pounds/square foot).
      2) ASTM E119: Fire Resistance - 3 hours (Classified by UL for use on fibrous/cementitious fireproofing).
      3) ASTM D2794: Gardner Impact Test; Impact Resistance - minimum 11.5 kg-mm (43 in/lb).
      4) ASTM D522: Mandrel Bend Test; Flexibility - no rupture or cracking
   c. Lockdown Encapsulants:
      1) ASTM E119: Fire resistance - 3 hours (tested with fireproofing over encapsulant applied directly to steel member).

2) ASTM E736: Bond Strength - 48 kPa (100 pounds/square foot) (test compatibility with cementitious and fibrous fireproofing).
3) In certain situations, encapsulants may have to be applied to hot pipes/equipment. The encapsulant must be able to withstand high temperatures without cracking or creating any noxious gaseous or vapors during or after application.

2.7 CERTIFICATES OF COMPLIANCE

A. The Contractor shall submit to the VA Representative certification from the manufacturer indicating compliance with performance requirements for encapsulants when applied according to manufacturer recommendations.
B. Recyclable Protective Clothing: If recyclable clothing is provided, all requirements of EPA, DOT and OSHA shall be met.

PART 3 - EXECUTION

3.1 REGULATED AREA PREPARATIONS

A. Site Security:
1. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and representatives, State and Local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and shall be posted in the clean room of the decontamination unit or in a designated area located immediately outside of the regulated area established for 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 COR or VA Representative using the most expeditious means.
3. A log book shall be maintained in the clean room of the decontamination unit or in a designated area located immediately outside of the regulated area established for 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. 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 - 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; transite piping/ductwork/sheets; behind radiators; lab fume hoods; transite lab countertops; roofing materials; below window sills; water/sewer lines; electrical conduit coverings; crawl spaces(previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; and steam line trench coverings.

3) Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination.
4) Inspect existing firestopping in the regulated area. Correct as needed.

3. Pre-Abatement Construction and Operations:
   a. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
   b. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's Representative when the work is completed in accordance with this specification. The VA's Representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP(s), especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation.

c. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's Representative.

d. Upon satisfactory inspection of the installation of and operation of systems the VA's Representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification.

3.2 REMOVAL OF PIPING ACM

A. Wetting Materials:

1. Use amended water for the wetting of ACM prior to removal. The Competent Person shall assure that the wetting of ACM meets the definition of "adequately wet" in the EPA NESHAP regulation and OSHA’s “wet methods” for the duration of the project. A removal encapsulant may be used instead of amended water with written approval of the VA's Representative.
2. Amended Water: Provide water to which a surfactant has been added to wet the ACM and reduce the potential for fiber release during disturbance of ACM. The mixture must be equal to or greater than the wetting provided by water amended by a surfactant consisting of one ounce of 50 percent polyoxyethylene ester and 50 percent polyoxyethylene ether mixed with 5 gallons (19L) of water.
3. Removal Encapsulant: Provide a penetrating encapsulant designed specifically for the removal of ACM. The material must, when used, result in adequate wetting of the ACM and retard fiber release during disturbance equal to or greater than the amended water described above in B.

B. Secondary Barrier and Walkways: Install as a drop cloth a 6-mil poly sheet at the beginning of each work shift where removal is to be done during that shift. Secure the drop cloth (6-mil poly sheet) with duct tape or approved equivalent to prevent it from moving or debris from getting behind it. Remove the drop cloth (6-mil poly sheet) at the end of the shift or as work in the area is completed. Keep residue on the drop cloth (6-mil poly sheet) wetted. When removing, fold inward to prevent spillage and place in a disposal bag.

C. Wet Removal of ACM: Using acceptable 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 and VA Representative, the VPIH/CIH will perform the final clearance testing. Air samples will be collected and analyzed in accordance with procedures for AHERA in this specification. If work is less than 260 lf/160 sf/35 cf, 5 PCM samples shall be collected for clearance and a minimum of two field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA presented in this specification. If the release criteria are not met, the Contractor shall repeat the final cleaning and continue decontamination procedures until clearance is achieved. All additional inspection and testing costs will be borne by the Contractor.
2. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

D. Final Air Clearance Procedures:

1. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured by the AHERA PCM protocol, and < 70 AHERA asbestos structures per square millimeter (s/mm2) by AHERA TEM. No averaging of results will be used for this project. All five (5) TEM samples inside the regulated area shall be at or below 70 asbestos s/mm2 to satisfy the project final clearance criteria.
2. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures:
   a. Fibers Counted: "Fibers" referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.
   b. Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques except where soil is not encapsulated or enclosed. Samples will be collected on 0.8µ 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 3850 Liters of air. A minimum of 5 PCM

clearance samples shall be collected. All samples must be equal to or less than 0.01 f/cc to clear the regulated area.

F. Clearance Sampling Using TEM:
   1. Clearance requires 13 samples be collected; 5 inside the regulated area; 5 outside the regulated area; and 3 field blanks.
   2. The TEM method will be used for clearance sampling with a minimum collection volume of 1200 Liters of air. A minimum of 13 clearance samples shall be collected. All samples must be equal to or less than 70 AHERA structures per square millimeter (s/mm2) AHERA TEM, no averaging of results for this specific project.

G. Laboratory Testing of PCM Samples: The services of an AIHA accredited laboratory will be employed by the VA to perform analysis for the PCM air samples. The accredited laboratory shall be successfully participating in the AIHA Proficiency Analytical Testing (PAT) program. Samples will be sent daily by the VPIH/CIH so that verbal/faxed reports can be received within 24-36 hours. A complete record, certified by the laboratory, of all air monitoring tests and results will be furnished to the VA’s Representative and the Contractor.

H. Laboratory Testing of Tem Samples: Samples shall be sent by the VPIH/CIH to a NIST NVLAP accredited laboratory for analysis by TEM. The laboratory shall be successfully participating in the NIST NVLAP Airborne Asbestos Analysis (TEM) program. Verbal/faxed results from the laboratory shall be available within 24-36 hours after receipt of the samples. A complete record, certified by the laboratory, of all TEM results shall be furnished to the VA's Representative and the Contractor.

3.8 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

A. Completion of Abatement Work: After thorough decontamination, seal negative air machines with 2-layers of 6-mil poly and duct tape to form a tight seal at the intake/outlet ends before removal from the regulated area. Complete asbestos abatement work upon meeting the regulated area visual and air clearance criteria and fulfilling the following:
   1. Remove all equipment, materials, and debris from the project area.
   2. Package and dispose of all asbestos waste as required. Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for

packaging must also be met. Transport will be in compliance with 49 CFR 171 – 180 regulations.

3. Repair or replace all interior finishes damaged during the abatement work.
4. The VA will be notified of any waste removed from the containment prior to 24 hours.
5. Fulfill other project closeout requirements as specified elsewhere in this specification.

B. Certificate of Completion by Contractor: The CPIH/CIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area.

C. Work Shifts: All work shall generally be done during administrative hours (8:00 AM to 4:30 PM) Monday - Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative.

D. Re-Insulation: If required as part of the contract, replace all asbestos containing insulation with suitable non-asbestos material. Provide SDS for all replacement materials.

ATTACHMENT #1
CERTIFICATE OF COMPLETION

DATE: _____ VA Project #: _____

PROJECT NAME: _____ Abatement Contractor: _____

VAMC/ADDRESS: _____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):
   which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer’s recommendations.

CPIH/CIH Signature/Date: _____

CPIH/CIH Print Name: _____

Abatement Contractor Signature/Date: _____

Abatement Contractor Print Name: _____

ATTACHMENT #2
CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME: _____ DATE: _____

PROJECT ADDRESS: _____

ABATEMENT CONTRACTOR'S NAME: _____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate of worker's acknowledgement you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32-hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

- Physical Characteristics and Background Information on Asbestos
- Potential Health Effects Related to Exposure to Asbestos
- Employee Personal Protective Equipment
- Establishment of a Respiratory Protection Program
- State of the Art Work Practices
- Personal Hygiene
- Additional Safety Hazards
- Medical Monitoring
- Air Monitoring
- Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
- Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature: _____
Printed Name: _____
Social Security Number: _____
Witness: _____

ATTACHMENT #3
AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER: _____

VA MEDICAL FACILITY: _____

ABATEMENT CONTRACTOR'S NAME AND ADDRESS: _____

1. I verify that the following individual
   Name: _____ Social Security Number: _____
   who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.
   Address: _____
2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH: _____ Date: _____

Printed Name of CPIH/CIH: _____

Signature of Contractor: _____ Date: _____

Printed Name of Contractor: _____

ATTACHMENT #4
ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location:_____

VA Project #:_____

VA Project Description:_____

This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature_____Date_____

- - - E N D - - -

SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete masonry unit (CMU) assemblies for:

1. Exterior walls.
2. Interior walls and partitions.

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. C34-13 - Structural Clay Load-Bearing Wall tile.
5. C55-14a - Concrete Building Brick.
6. C56-13 - Structural Clay Nonloadbearing Tile.
7. C62-13a - Building Brick (Solid Masonry Units Made from Clay or Shale).
8. C67-14 - Sampling and Testing Brick and Structural Clay Tile.
9. C90-14 - Load-Bearing Concrete Masonry Units.
10. C126-15 - Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
11. C216-15 - Facing Brick (Solid Masonry Units Made From Clay or Shale).
12. C612-14 - Mineral Fiber Block and Board Thermal Insulation.
13. C744-14 - Prefaced Concrete and Calcium Silicate Masonry Units.
14. D1056-14 - Flexible Cellular Materials - Sponge or Expanded Rubber.
15. D2240-05(2010) - Rubber Property-Durometer Hardness.
16. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.

D. American Welding Society (AWS):

1. D1.4/D1.4M-11 - Structural Welding Code - Reinforcing Steel.

E. Brick Industry Association (BIA):
   1. TN 11B-88 - Guide Specifications for Brick Masonry, Part 3.
F. Federal Specifications (Fed. Spec.):
   1. FF-S-107C(2) - Screws, Tapping and Drive.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Submittal Drawings:
   1. Fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies.
   2. Special masonry shapes, profiles, and placement.
   3. Masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.
C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Installation instructions.
D. Samples:
   1. Face brick: Sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
   2. Ceramic Glazed Facing Brick: Sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
   3. Concrete masonry units, when exposed in finish work.
   4. Anchors and Ties: Each type.
   5. Joint Reinforcing: 1200 mm (48 inches) long each type.
   6. Glazed Structural Facing Tile: Clipped panels (triplicate) of four wall units with base units, showing color range, each color and texture.
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.
   1. Ceramic glazed facing brick.
G. Certificates: Certify products comply with specifications.
   1. Face brick.

2. Solid and load-bearing concrete masonry units, including fire-resistant rated units.
3. Ceramic glazed facing brick.
4. Glazed structural clay facing tile.
5. Structural clay tile 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.

B. Mockups:

1. Before starting masonry, build a mockup panel minimum 1800 mm by 1800 mm (6 feet by 6 feet) with 600 mm (24 inch) 90 degree return for outside corner.
   a. Use masonry units from random cubes of units delivered on site.
   b. Include structural backup, reinforcing, ties, and anchors.
2. Mockup panel approved by COR set workmanship and aesthetic quality for masonry work.
3. Clean sample panel to test cleaning methods.
4. Remove mockup panel when directed by COR.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products above grade, protected from contamination.

B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Hot and Cold Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.

2.3 UNIT MASONRY PRODUCTS

A. Brick:
   1. Face Brick:
      a. ASTM C216, Grade SW, Type FBS.
      b. Brick when tested according to ASTM C67: Classified slightly efflorescent or better.
      c. Size:
         1) Modular.
         2) Thin Brick: 13 mm (1/2 inch) thick with angle shapes for corners.
   2. Building Brick: ASTM C62, Grade MW for backup and interior work; Grade SW where in contact with earth.
   3. Ceramic Glazed Facing Brick: ASTM C126.
   4. One Face Exposed: Grade S, Type I.
   5. Two Faces Exposed: Grade S, Type II.

B. Concrete Masonry Units (CMU):
   1. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
      a. Unit Weight: 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).
   5. Customized Units:
      a. Sound-Absorbing Units:
         1) Vertical slots in face to core areas.

2) Acoustical absorption insert: Mineral fiber and metal septum, providing unit with NRC rating of 0.70.

b. Split-Face Units:

1) Split-Rib Units: Rib shapes as indicated on drawings on exposed faces.

2) Ground Face Units: Ground, Honed, Filled and polished finish on exposed faces.

c. Glazed Face Units: Facing conform to ASTM C744.

C. Concrete Brick: ASTM C55.

D. Clay Tile Units:

1. Glazed Structural Facing Tile:

a. ASTM C126, Grade S, Type I (single faced units) and Type II (two-faced units).

2. Shall match existing.

E. Structural Clay Non-Load-Bearing Tile: ASTM C56, Grade NB.

F. Use keyed surface structural clay tile units required to receive plaster or mortar.

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 4 mm (0.16 inch).

b. Cross wires 2.6 mm (0.10 inch).

9. Trussed Design:

a. Longitudinal and cross wires minimum 4 mm (0.16 inch nominal) diameter.

b. Longitudinal wires deformed.

10. Multiple Wythes and Cavity Wall Ties:
    a. Longitudinal wires 4 mm (0.16 inch), two in each wythe with ladder truss wires 4 mm (0.16 inch) overlay, welded to each longitudinal wire.
    b. Longitudinal wires 4 mm (0.16 inch) with U shape 4 mm (0.16 inch) rectangular ties extending into other wythe minimum 75 mm (3 inches) spaced 400 mm on center (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches min.).

C. Adjustable Veneer Anchor for Framed Walls:
    1. Two piece, adjustable anchor and tie.
    2. Anchor and tie may be either loop or angle type; provide only one type throughout.
    3. Loop Type:
        a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
        b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage anchor and be embedded minimum 50 mm (2 inches) into bed joint of masonry veneer.
    4. Angle Type:
        a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.
        b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded minimum 50 mm (2 inches) into the bed joint of masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.

D. Dovetail Anchors:
    1. Corrugated steel dovetail anchors formed of 1.5 mm (0.06 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry units,

140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.

2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend minimum 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.
3. Form dovetail anchor slots from 0.6 mm (0.02 inch) thick galvanized steel (with felt or fiber filler).

E. Individual Ties:
1. Rectangular ties: Form from 5 mm (3/16 inch) diameter galvanized steel rod to rectangular shape minimum 50 mm (2 inches) wide by sufficient length for ends of ties to extend within 25 mm (1 inch) of each face of wall. Ties that are crimped to form drip are not acceptable.
2. Adjustable Cavity Wall Ties:
a. Adjustable wall ties may be furnished at Contractor's option.
b. Two piece type permitting up to 40 mm (1-1/2 inch) adjustment.
c. Form ties from 5 mm (3/16 inch) diameter galvanized steel wire.
d. Form one piece to rectangular shape 105 mm (4-1/8 inches) wide by length required to extend into bed joint 50 mm (2 inches).
e. Form other piece to 75 mm (3 inch) long by 75 mm (3 inch) wide shape, having 75 mm (3 inch) long bent section for engaging 105 mm (4-1/8 inch) wide piece to form adjustable connection.

F. Wall Ties, (Mesh or Wire):
1. Mesh wall ties formed of ASTM A1064/A1064M, W0.5, 2 mm, (0.08 inch) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.
2. Rectangular wire wall ties formed of W1.4, 3 mm, (0.12 inch) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.

G. Corrugated Wall Tie:
1. Form from 1.5 mm (0.06 inch) thick corrugated, galvanized steel 30 mm (1-1/4 inches) wide by lengths to extend minimum 100 mm (4 inches) into joints of masonry plus 38 mm (1-1/2 inch) turn-up.
2. Provide 5 mm (3/16 inch) hole in turn-up for fastener attachment.

H. Adjustable Steel Column Anchor:
   1. Two piece anchor consisting of a 6 mm (1/4 inch) diameter steel rod to be welded to steel with offset ends, rod to permit 100 mm (4 inch) vertical adjustment of wire anchor.
   2. Triangular shaped wire anchor 100 mm (4 inches) wide formed from 5 (3/16 inch) diameter galvanized wire, to extend minimum 75 mm (3 inches) into joints of masonry.

I. Adjustable Steel Beam Anchor:
   1. Z or C type steel strap, 30 mm (1 1/4 inches) wide, 3 mm (1/8 inch) thick.
   2. Flange hook minimum 38 mm (1 1/2 inches) long.
   3. Length to embed in masonry minimum 50 mm (2 inches) in 100 mm (4 inch) nominal thick masonry and 100 mm (4 inches) in thicker masonry.
   4. Bend masonry end minimum 40 mm (1 1/2 inches).

J. Ridge Wall Anchors:
   1. Form from galvanized steel minimum 25 mm (1 inch) wide by 5 mm (3/16 inch) thick by 600 mm (24 inches) long, plus 50 mm (2 inch) bends.
   2. Other lengths as indicated on drawings.

2.5 ACCESSORIES

A. Weeps:
   1. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
   2. Weep Tubing: Round, polyethylene, 9 mm (3/8 inch) diameter, 100 mm (4 inches) long.
   3. Weep Hole: Flexible PVC louvered configuration with rectangular closure strip at top.

B. Cavity Drain Material: Open mesh polyester sheets or strips to prevent mortar droppings from clogging the cavity.

C. 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.

D. Box Board:
   1. Mineral Fiber Board: ASTM C612, Type 1.
   2. 25 mm (1 inch) thickness.

3. Other spacing material having similar characteristics is acceptable subject to COR's approval.

E. 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.

F. 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.

G. 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 COR 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. Restore/Patch wall openings after demolition and pipe removal where required.
3. When items are not available when walls are built, prepare openings for subsequent installation.

D. Tooling Joints:
1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
2. Tool while mortar is soft enough to be compressed into joints and not raked out.
3. Finish joints in exterior face masonry work with jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.

4. Tool Exposed interior joints in finish work concave unless specified otherwise.

E. Partition Height:
1. Extend partitions minimum 100 mm (4 inches) above suspended ceiling or to overhead construction where no ceiling occurs.
2. Extend following partitions to overhead construction.
a. Full height partitions, and fire partitions and smoke partitions indicated on drawings.
b. Both walls at expansion joints.
c. Corridor walls.
d. Walls at stairway and stair halls, elevators, dumbwaiters, trash and laundry chute shafts, and other vertical shafts.
e. Walls at refrigerator space.
f. Reinforced masonry partitions.
3. Extend finished masonry partitions minimum 100 mm (4 inches) above suspended ceiling and continue with concrete masonry units or structural clay tile to overhead construction:

F. Wall, Furring, and Partition Units:
1. Lay out field units to provide one-half running bond, unless indicated otherwise.
2. Align head joints of alternate vertical courses.
3. At sides of openings, balance head joints in each course on vertical center lines of openings.
4. Minimum Masonry Unit Length: 100 mm (4 inches).
5. On interior partitions provide 6 mm (1/4 inch) open joint for caulking between existing construction, exterior walls, concrete work, and abutting masonry partitions.
6. Use minimum 100 mm (4 inches) nominal thick masonry for free standing furring, unless indicated otherwise.
7. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.

G. Use minimum 100 mm (4 inches) nominal thick masonry for fireproofing steel columns unless indicated otherwise.

H. Before connecting new masonry with previously laid masonry, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.

I. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.

J. 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.

K. 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.

L. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

M. 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.

N. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other reasonable temporary construction loads.

O. Minimum Curing Times Before Removing Shores and Forms:

1. Girders and Beams: 10 days.
2. Slabs: 7 days.
3. Reinforced Masonry Soffits: 7 days.

3.2 INSTALLATION - ANCHORAGE

A. Veneer to Framed Walls:

1. Install adjustable veneer anchors.
2. Fasten anchor to stud through sheathing with self-drilling and tapping screw, one at both ends of loop type anchor.

3. Space anchors maximum 400 mm (16 inches) on center vertically at each stud.

B. Veneer to Concrete Walls:

1. Install dovetail slots in concrete vertically at 400 mm (16 inches) on centers.
2. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals.
3. Anchor new masonry facing to existing concrete with adjustable cavity wall ties spaced at 400 mm, (16 inches) maximum vertical intervals, and at 400 mm (16 inches) maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.

C. Masonry Facing to Backup and Cavity Wall Ties:

1. Use individual ties for new work.
2. Stagger ties in alternate courses, and space at 400 mm (16 inches) maximum vertically, and 400 mm (16 inches) horizontally.
3. At openings, provide additional ties spaced maximum 900 mm (36 inches) apart vertically around perimeter of opening, and within 300 mm (12 inches) from edge of opening.
4. Anchor new masonry facing to existing masonry with adjustable cavity wall ties spaced at 400 mm (16 inch) maximum vertical intervals and at every second masonry unit horizontally. Fasten ties to masonry with masonry nails.
5. Option: Install joint reinforcing for multiple wythes and cavity wall ties spaced maximum 400 mm (16 inches) vertically.
6. Tie interior and exterior wythes of reinforced masonry walls together with individual ties. Provide ties at intervals maximum 400 mm (16 inches) on center horizontally, and 400 mm (16 inches) on center vertically. Lay ties in the same line vertically in order to facilitate vibrating of the grout pours.

D. 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.

E. Masonry Furring:
1. Anchor masonry furring less than 100 mm (4 inches) nominal thick to masonry walls or to concrete with adjustable wall ties or dovetail anchors.
2. Space at maximum 400 mm (16 inches) on center in both directions.

F. 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 - 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 existing construction, exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings minimum 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge masonry against steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes indicated on drawings.
12. At time of placement, ensure steel reinforcement is free of loose rust, mud, oil, and other contamination capable of affecting bond.
13. Place steel reinforcement at spacing indicated on drawings before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place vertically by centering clips, caging devices, tie wire, or other approved methods.
16. Support vertical bars near each end and at maximum 192 bar diameter on center.

17. Splice reinforcement or attach reinforcement to dowels by placing in contact and securing with wire ties.
18. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
19. Grout cells of concrete masonry units, containing reinforcing bars, solid as specified.
20. Install cavity and joint reinforcement as masonry work progresses.
21. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

C. Waterproofing Parging:
1. Parge earth side of concrete masonry unit basement walls with mortar applied in two coats, each coat 6 mm (1/4 inch) thick.
2. Clean wall surfaces to receive parging of dirt, oil, or grease, and moisten before application of first coat.
3. Roughen first coat when partially set, permit to hardened for 24 hours, and moisten before application of second coat.
4. Keep second coat damp for minimum 48 hours.
5. Thicken parging and round to form a cove at the junction of outside wall face and footing.

D. Fill joints with pointing mortar using rubber float trowel to apply mortar solidly into raked joints.

E. Wipe off excess mortar from joints of glazed masonry units with dry cloth.

F. Tool exposed joints to smooth concave joint.

G. At joints with existing work, match existing joint.
1.

3.4 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.

3.5 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. Splice reinforcement bars only where indicated on drawings, unless approved by COR. Provide lapped splices. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

D. Provide minimum lap as indicated on approved submittal drawings, or if not indicated, minimum 48 bar diameters.

3.6 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).

3.7 CLEANING AND REPAIR

A. General:

1. Clean exposed masonry surfaces on completion.
2. Protect adjoining construction materials and landscaping during cleaning operations.

3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
4. Remove mortar droppings and other foreign substances from wall surfaces.

B. Brickwork:
1. First wet surfaces with clean water, then wash down with detergent solution. Do not use muriatic acid.
2. Brush with stiff fiber brushes while washing, and immediately wash with clean water.
3. Remove traces of detergent, foreign streaks, or stains of any nature.

C. Concrete Masonry Units:
1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.

D. Glazed Structural Facing Tile or Brick Units:
1. Clean as recommended manufacturer. Protect light colored mortar joints from discoloration during cleaning.
2. Use on solid masonry walls.
3. Prepare schedule of test locations.

- - - E N D - - -

SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide UL or equivalent approved firestopping system for the closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.

B. Provide UL or equivalent approved firestopping system for the closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS: Sealants and application.

1.3 SUBMITTALS

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

B. Installer qualifications.

C. Inspector qualifications.

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

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

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

G. Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.

1.4 DELIVERY AND STORAGE

A. Deliver materials in their original unopened containers with manufacturer’s name and product identification.

B. Store in a location providing protection from damage and exposure to the elements.

1.5 QUALITY ASSURANCE

A. FM, UL, or WH or other approved laboratory tested products will be acceptable.

B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply with UL’s “Qualified Firestop Contractor Program Requirements.” Submit qualification data.

C. Inspector Qualifications: Contractor to engage a qualified inspector to perform inspections and final reports. The inspector to meet the criteria contained in ASTM E699 for agencies involved in quality assurance and to have a minimum of two years' experience in construction field inspections of firestopping systems, products, and assemblies. The inspector to be completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector qualifications.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

E84-20.....Surface Burning Characteristics of Building Materials

E699-16.....Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components

E814-13a(2017).....Fire Tests of Penetration Firestop Systems

E2174-20a.....Standard Practice for On-Site Inspection of Installed Firestop Systems

E2393-20.....Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

C. FM Global (FM):

Annual Issue Approval Guide Building Materials

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

D. Underwriters Laboratories, Inc. (UL):

Annual Issue Building Materials Directory

E. Annual Issue Fire Resistance Directory

723-Edition 11(2018)....Standard for Test for Surface Burning Characteristics of Building Materials

1479-04(2015).....Fire Tests of Penetration Firestops

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

Annual Issue Certification Listings

G. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

A. Provide either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke. Firestop systems to accommodate building movements without impairing their integrity.

B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 101 mm (4 inches) nominal pipe or 0.01 square meter (16 square inches) in overall cross sectional area.

C. Firestop sealants used for firestopping or smoke sealing to have the following properties:

1. Contain no flammable or toxic solvents.
2. Release no dangerous or flammable out gassing during the drying or curing of products.
3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
4. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
5. VOC Content: Firestopping sealants and sealant primers to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
   a. Sealants: 250 g/L.
   b. Sealant Primers for Nonporous Substrates: 250 g/L.
   c. Sealant Primers for Porous Substrates: 775 g/L.

D. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials to have following properties:

1. Classified for use with the particular type of penetrating material used.

2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.

E. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84 or UL 723. Material to be an approved firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.

F. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.

G. Materials to be nontoxic and noncarcinogen at all stages of application or during fire conditions and to not contain hazardous chemicals. Provide firestop material that is free from Ethylene Glycol, PCB, MEK, and asbestos.

H. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 101 mm (4 inches) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

A. Provide silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.

B. Provide mineral fiber filler and bond breaker behind sealant.

C. Sealants to have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with ASTM E84.

D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Submit product data and installation instructions, as required by article, submittals, after an on-site examination of areas to receive firestopping.

B. Examine substrates and conditions with installer present for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, grease, oil, laitance and form-release agents from concrete, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.

B. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on each side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

C. Prime substrates where required by joint firestopping system manufacturer using that manufacturer’s recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Masking Tape: Apply masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

3.3 INSTALLATION

A. Do not begin firestopping work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.

B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.

C. Install smoke stopping seals in smoke partitions.

3.4 CLEAN-UP

A. As work on each floor is completed, remove materials, litter, and debris.

B. Clean up spills of liquid type materials.

C. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

D. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to provide firestopping complying with specified requirements.

3.5 INSPECTIONS AND ACCEPTANCE OF WORK

A. Do not conceal or enclose firestop assemblies until inspection is complete and approved by the 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.

- - - E N D - - -

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. Masonry Control and Expansion Joint: Section 04 20 00, UNIT MASONRY.

B. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.

C. Mechanical Work: Section 22 05 11 COMMON WORK RESULTS FOR PLUMBING.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.

B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.

C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Lab Tests: Submit samples of materials that will be in contact or affect joint sealants to joint sealant manufacturers for tests as follows:
   1. Adhesion Testing: Before installing elastomeric sealants, test their adhesion to protect joint substrates according to the method in ASTM C794 to determine if primer or other specific joint preparation techniques are required.
   2. Compatibility Testing: Before installing elastomeric sealants, determine compatibility when in contact with glazing and gasket materials.
   3. Stain Testing: Perform testing per ASTM C1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work is to start until results of these tests have been submitted to the COR and the COR has given written approval to proceed with the work.

E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
   1. Locate test joints where indicated in construction documents or, if not indicated, as directed by COR.
   2. Conduct field tests for each application indicated below:
      a. Each type of elastomeric sealant and joint substrate indicated.
      b. Each type of non-elastomeric sealant and joint substrate indicated.
   3. Notify COR seven (7) days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint sealant manufacturer’s technical representative present.

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

1.4 CERTIFICATION

A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are

compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

1.5 SUBMITTALS

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

B. Installer qualifications.

C. Contractor certification.

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

E. Cured samples of exposed sealants for each color.

F. Manufacturer's Literature and Data:

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

G. Manufacturer warranty.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not proceed with installation of joint sealants under following conditions:
   a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).
   b. When joint substrates are wet.

B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 DELIVERY, HANDLING, AND STORAGE

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.8 DEFINITIONS

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Backing Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

1.9 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.10 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. ASTM International (ASTM):

C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material

C612-14.....Mineral Fiber Block and Board Thermal Insulation

C717-14a.....Standard Terminology of Building Seals and Sealants

C734-06(R2012).....Test Method for Low-Temperature Flexibility of Latex Sealants after Artificial Weathering

C794-10.....Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants

C919-12.....Use of Sealants in Acoustical Applications.

C920-14a.....Elastomeric Joint Sealants.

C1021-08(R2014).....Laboratories Engaged in Testing of Building Sealants

C1193-13.....Standard Guide for Use of Joint Sealants.

C1248-08(R2012).....Test Method for Staining of Porous Substrate by Joint Sealants

C1330-02(R2013).....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants

C1521-13.....Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints

D217-10.....Test Methods for Cone Penetration of Lubricating Grease

D1056-14.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber

E84-09.....Surface Burning Characteristics of Building Materials

C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

D. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 SEALANTS

A. Exterior Sealants:

1. S-# Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
2. S-# 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. S-#

2. S-# 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. S-# Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
3. S-# Food Service: Use a Vinyl Acetate Homopolymer, or other low VOC, non-toxic sealant approved for use in food preparation areas.
4. Provide location(s) of interior sealant as follows:
   a. Typical narrow joint 6 mm, (1/4 inch) or less at walls and adjacent components.
   b. Perimeter of doors, windows, access panels which adjoin concrete or masonry surfaces.
   c. Interior surfaces of exterior wall penetrations.
   d. Joints at masonry walls and columns, piers, concrete walls or exterior walls.
   e. Perimeter of lead faced control windows and plaster or gypsum wallboard walls.
   f. Exposed isolation joints at top of full height walls.
   g. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplanar tile surfaces meet.
   h. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.
   i. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.

D. Acoustical Sealant:

1. Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.
2. Provide location(s) of acoustical sealant as follows:
   a. Exposed acoustical joint at sound rated partitions.
   b. Concealed acoustic joints at sound rated partitions.
   c. Joints where item pass-through sound rated partitions.

2.2 COLOR

A. Sealants used with exposed masonry are to match color of mortar joints.

B. Sealants used with unpainted concrete are to match color of adjacent concrete.

C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.3 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint

where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 WEEPS

A. Weep/Vent Products: Provide the following unless otherwise indicated or approved.

1. Round Plastic Tubing: Medium-density polyethylene, 10 mm (3/8-inch) OD by thickness of stone or masonry veneer.

2.5 FILLER

A. Mineral fiberboard: ASTM C612, Class 1.

B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

2.6 PRIMER

A. As recommended by manufacturer of caulking or sealant material.

B. Stain free type.

2.7 CLEANERS-NON POROUS SURFACES

A. Chemical cleaners compatible with sealant and acceptable to manufacturer of sealants and sealant backing material. Cleaners to be free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS

A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals’ Guide).

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.

1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.

2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include but are not limited to the following:
   a. Concrete.
   b. Masonry.
   c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous surfaces include but are not limited to the following:
   a. Metal.
   b. Glass.
   c. Porcelain enamel.
   d. Glazed surfaces of ceramic tile.

C. Do not cut or damage joint edges.

D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.
1. Apply primer prior to installation of back-up rod or bond breaker tape.
2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION

A. Install backing material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the backing rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.

D. Install backing rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

E. Where space for backing rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

3.4 SEALANT DEPTHS AND GEOMETRY

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION

A. General:

1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).
2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to “skin” over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
11. Replace sealant which is damaged during construction process.

B. Weeps: Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, at all flashing, and as indicated on construction documents.
   1. Use round plastic tubing to form weep holes.
   2. Space weep holes formed from plastic tubing not more than 406 mm (16 inches) o.c.
   3. Trim tubing material used in weep holes flush with exterior wall face after sealant has set.

C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.

D. Interior Sealants: Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
   1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
   2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
   3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
   4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
   5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

1. Extent of Testing: Test completed elastomeric sealant joints as follows:
   a. Perform 10 tests for first 305 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
   b. Perform one test for each 305 m (1000 feet) of joint length thereafter or one test per each floor per elevation.

B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.

C. Inspect tested joints and report on following:

1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
2. Compare these results to determine if adhesion passes sealant manufacturer’s field-adhesion hand-pull test criteria.
3. Whether sealants filled joint cavities and are free from voids.
4. Whether sealant dimensions and configurations comply with specified requirements.

D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with

other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.7 CLEANING

A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by manufacturer of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.

B. Leave adjacent surfaces in a clean and unstained condition.

- - - E N D - - -

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. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

B. Lay in gypsum board ceiling panels: Section 09 51 00, ACOUSTICAL CEILING.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.

C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

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

B. Manufacturer's Literature and Data:

1. Cornerbead and edge trim.
2. Finishing materials.
3. Laminating adhesive.
4. Gypsum board, each type.

C. 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.

1.6 ENVIRONMENTAL CONDITIONS

In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing And Materials (ASTM):

C11-15.....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.
      c. Sound rated partitions.
      d. Full height partitions shown (FHP).
      e. Corridor partitions.
   2. One side of partitions or furring:
      a. Inside of exterior wall furring or stud construction.
      b. Room side of room without suspended ceilings.
      c. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.
   3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.

B. In locations other than those specified, extend gypsum board from floor to heights as follows:
   1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
   2. At ceiling of suspended gypsum board ceilings.
   3. At existing ceilings.

3.2 INSTALLING GYPSUM BOARD

A. Coordinate installation of gypsum board with other trades and related work.

B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.

C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.

D. Use gypsum boards in maximum practical lengths to minimize number of end joints.

E. Bring gypsum board into contact, but do not force into place.

F. Ceilings:

1. For single-ply construction, use perpendicular application.
2. For two-ply assembles:
   a. Use perpendicular application.
   b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.

G. Walls (Except Shaft Walls):

1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
3. Stagger screws on abutting edges or ends.
4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
6. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
8. Installing Two Layer Assembly Over Sound Deadening Board:
   a. Apply face layer of wallboard vertically with joints staggered from joints in sound deadening board over framing members.

b. Fasten face layer with screw, of sufficient length to secure to framing, spaced 300 mm (12 inches) on center around perimeter, and 400 mm (16 inches) on center in the field.

9. Control Joints ASTM C840 and as follows:
   a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
   b. Not required for wall lengths less than 9000 mm (30 feet).
   c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.

H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
   1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
   2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
   3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.

I. Electrical and Telecommunications Boxes:
   1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.

J. Accessories:
   1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
   2. Install in one piece, without the limits of the longest commercially available lengths.
   3. Corner Beads:
      a. Install at all vertical and horizontal external corners and where shown.
      b. Use screws only. Do not use crimping tool.
   4. Edge Trim (casings Beads):
      a. At both sides of expansion and control joints unless shown otherwise.

b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
d. Where shown.

3.3 INSTALLING GYPSUM SHEATHING

A. Install in accordance with ASTM C840, except as otherwise specified or shown.
B. Use screws of sufficient length to secure sheathing to framing.
C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.
D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.
E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

3.4 CAVITY SHAFT WALL

A. Conform to UL Design No. U438 or FM WALL CONSTRUCTION 12-2/HR (Nonbearing for two-hour fire rating. Conform to FM WALL CONSTRUCTION 25-1/HR (Non-loadbearing) for one-hour fire rating where shown.
B. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
   1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
   2. Stagger joints top and bottom in adjacent panels.
   3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
C. Gypsum Board:
   1. Two hour wall:
      a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 25 mm (one inch) long screws, spaced 600 mm (24 inches) on center.
      b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.

c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.

2. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 300 mm (12 inches) on center in field and along edges.
3. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.

D. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

E. Elevator Shafts:

1. Protrusions including fasteners other than flange of shaft wall framing system or offsets from vertical alignments more than 3 mm (1/8-inch) are not permitted unless shown.
2. Align shaft walls for plumb vertical flush alignment from top to bottom of shaft.

3.5 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for al finished areas open to public view.

B. Before proceeding with installation of finishing materials, assure the following:

1. Gypsum board is fastened and held close to framing or furring.
2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non decorated or smoke barrier, or fire rated and/or sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier and fire rated construction/ Sanding is not required of non decorated surfaces.

3.6 REPAIRS

A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.

B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke tight construction and fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

3.7 UNACCESSIBLE CEILINGS

At Mental Health and Behavioral Nursing Units, areas accessible to patients and not continuously observable by staff (e.g., patient bedrooms, day rooms), ceilings should be a solid material such as gypsum board. This will limit patient access. Access doors are needed to access electrical and mechanical equipment above the ceiling. These doors should be locked to prevent unauthorized access and secured to ceiling using tamper resistant fasteners.

- - - E N D - - -

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical units.
2. Metal ceiling suspension system for acoustical ceilings.
3. Adhesive application.

1.2 RELATED REQUIREMENTS

A. Lay in gypsum board ceiling panels: Section 09 29 00, GYPSUM BOARD.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

1. A641/A641M-09a(2014) - Zinc-coated (Galvanized) Carbon Steel Wire.
2. A653/A653M-15e1 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process.
3. C423-09a - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
4. C634-13 - Terminology Relating to Environmental Acoustics.
5. C635/C635M-13a - Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
6. C636/C636M-13 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
7. D1779-98(2011) - Adhesive for Acoustical Materials.
8. E84-15b - Surface Burning Characteristics of Building Materials.
9. E119-16 - Fire Tests of Building Construction and Materials.
10. E413-16 - Classification for Rating Sound Insulation.
11. E580/E580M-14 - Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.
12. E1264-14 - Classification for Acoustical Ceiling Products.

C. International Organization for Standardization (ISO):

1. ISO 14644-1 - Classification of Air Cleanliness.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting minimum 30 days before beginning Work of this section.

1. Required Participants:

a. COR.

b. Architect/Engineer and Interior Designer.
c. VA Interior Designer.
d. Inspection and Testing Agency.
e. Contractor.
f. Installer.
g. Other installers responsible for adjacent and intersecting work, including sprinkler, plumbing, and lighting installers.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
a. Installation schedule.
b. Installation sequence.
c. Preparatory work.
d. Protection before, during, and after installation.
e. Installation.
f. Terminations.
g. Transitions and connections to other work.
h. Inspecting and testing.
i. Other items affecting successful completion.

3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Ceiling suspension system indicating manufacturer recommendation for each application.
3. Installation instructions.
4. Warranty.

D. Samples:
1. Acoustical units, 150 mm (6 inches) in size, each type, including units specified to match existing.
a. Submit quantity required to show full color and texture range.
2. Suspension system, trim and molding, 300 mm (12 inches) long.
3. Colored markers for access service.

4. Approved samples may be incorporated into work.

E. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
2. Biobased Content:
   a. Show type and quantity for each product.
   b. Show volatile organic compound types and quantities.

F. Certificates: Certify each product complies with specifications.

1. Acoustical units, each type.

G. Qualifications: Substantiate qualifications comply with specifications.

1. Manufacturer with project experience list.

H. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Regularly manufactures specified products.
2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
   a. Project Experience List: Provide contact names and addresses for completed projects.

1.7 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.8 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight conditioned facility.

B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Conditions: HVAC systems are complete, operational, and maintaining facility design operating conditions

continuously, beginning 48 hours before installation until Government occupancy.

3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Ceiling System: Acoustical ceilings units on exposed or concealed grid suspension systems.

2.2 SYSTEM PERFORMANCE

A. Design product complying with specified performance:
   1. Maximum Deflection: 1/360of span, maximum.
B. Fire Resistance: ASTM E119; as component of 2 hour rated floor-ceiling or roof-ceiling assembly.
C. Surface Burning Characteristics: When tested according to ASTM E84.
   1. Flame Spread Rating: 25 maximum.
   2. Smoke Developed Rating: 450 maximum.

2.3 PRODUCTS - GENERAL

A. Provide acoustical units from one manufacturer.
   1. Provide each product exposed to view from one production run.
B. Provide suspension system from same manufacturer.
C. Sustainable Construction Requirements:
   1. Mineral Base Recycled Content: 65 percent, recycled content, minimum. Select products with recycled content to achieve overall Project recycled content requirement.
   2. Steel Recycled Content: 30 percent total recycled content, minimum.
   3. Aluminum Recycled Content: 80 percent total recycled content, minimum.
   4. Biobased Content: 37 percent by weight biobased material, minimum.

2.4 ACOUSTICAL UNITS

A. General:
   1. Ceiling Panel and Tile: ASTM E1264, bio-based content according to USDA Bio-Preferred Product requirements.
      a. Mineral Fiber: 3.6 kg/sq. m (3/4 psf) weight, minimum.
      b. Integrally colored units.

2. Classification: Provide type and form as follows:
   a. Type III Units - Mineral base with water-based painted finish maximum 10 g/l VOC; Form 2 - Water felted, minimum 16 mm (5/8 inch) thick.
   b. Type IV Units - Mineral base with membrane-faced overlay, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick. Apply poly (vinyl) chloride over paint coat.
   c. Type V Units - Perforated steel facing (pan) with mineral or glass fiber base backing.
      1) Steel: Galvanized steel, ASTM A653, with G30 coating. minimum 0.38 mm (0.015 inch) thick.
      2) Bonderize both sides. Apply two coats of baked-on enamel finish on surfaces exposed to view and one coat on concealed surfaces.
   d. Type VI Units - Perforated stainless steel facing (pan) with mineral or glass fiber base backing.
   e. Type VII Units - Perforated aluminum facing (pan) with mineral or glass fiber base backing.
      1) Aluminum sheets, minimum 0.635 mm (0.025 inch) thick.
      2) Apply two coats of baked-on enamel finish, free from gloss or sheen, on face and flanges.
   f. NRC (Noise Reduction Coefficient): ASTM C423, minimum 0.55 unless specified otherwise.
   g. CAC (Ceiling Attenuation Class): ASTM E413, 40-44 range unless specified otherwise.
   h. LR (Light Reflectance): Minimum 0.75.
3. Lay-in panels: Sizes as indicated on Drawings, with square edges or reveal edges.
   a. Sizes:
      1) Concealed Grid Upward Access System: 300 by 300 (12 by 12) or 300 by 600 mm (12 by 24 inch).
      2) Cross Score: 300 by 600 mm (12 by 24 inch) tile to simulate 300 by 300 mm (12 by 12 inch) tile edges.
      3) Edge and Joint Detail: Beveled or Square edges and joints as required to suit suspension and access system.

4. Perforated Metal Facing (Pan):
   a. Tiles Size: 300 by 300 (12 by 12), 300 by 600 (12 by 24), 300 by 900(12 by 36) and 300 by 1200 mm (12 by 48 inches).
      1) Cross Score Units: Larger than 300 by 300 mm (12 by 12 inches) to simulate 300 by 300 mm (12 by 12 inch) units.
      2) Edge and Joint Detail: Beveled edge, joints for snap-in attachment to suspension system.
   b. Panels: Sizes as indicated on Drawings with recessed reveal edges or flat panel with square edges to finish flush with exposed grid suspension system.
   c. Sound Absorbent Element: Non-sifting mineral wool or glass fiber (formaldehyde-free). Density and thickness to provide specified noise reduction coefficient. Enclose sound absorbent elements within plastic envelopes.
   d. Support sound absorbent elements on wire spacer nominal 6 mm (1/4 inch) high. Fit sound absorbent element and the spacer into the unit.
5. Adhesive Applied Tile:
   a. Size: 300 by 300 mm (12 by 12 inch) size.
   b. Edges: Beveled or Square.

B. SPECIAL FACED ACOUSTICAL TILE UNITS AT(SP): Anti-microbial coated surfaces suitable for use in Class 5 Clean Rooms per ISO 14644-1. Special faced acoustical tile units shall meet all general requirements stated in this specification.
1. Type XX-A Units - Perforated Ceramic Units for Wet Service.
   a. Mineral wool material, fired in kiln to produce a stable panel, totally unaffected by moisture when submerged in water.
   b. No damage when subjected to 10 cycles of steam at 135 degrees C (275 degrees F) and cooling to 10 degrees C (50 degrees F).
   c. Minimum of 16 mm (5/8 inch) thick.
   d. Not affected when immersed in five percent chlorine solution, except for paint finish.
2. Type III-A Units - Mineral base with painted finish.
   a. Form 1, modular, cast or molded.
   b. NRC: 0.75 minimum.
   c. Thickness: 19 mm (3/4 inch) minimum.
   d. Weight, 4.9 kg/sq. m (one pound per square foot).

3. Type XX-B Units - Combination mineral base and glass fiber with fabric finish.
   a. Back Half of Panel: Perforated water felted mineral fiber.
   b. Face Half of Panel: Glass fiber with glass cloth face.
   c. NRC: 0.75 minimum.
   d. Thickness: 28 mm (1 1/8 inches) minimum.

2.5 METAL SUSPENSION SYSTEM

A. General: ASTM C635, intermediate-duty or heavy-duty system, except as otherwise specified.
   1. Suspension System: Provide the following:
      a. Galvanized cold-rolled steel, bonderized.
      b. Extruded aluminum.
      c. Fire resistant plastic (glass fiber).
   2. Main and Cross Runner: Use same construction Do not use lighter-duty sections for cross runners.

B. Exposed Grid Suspension System: Support of lay-in panels.
   1. Grid Width: 22 mm (7/8 inch) minimum with8 mm (5/16 inch) minimum panel bearing surface.
   2. Molding: Fabricate from the same material with same exposed width and finish.
   3. Finish: Baked-on enamel flat texture finish.

C. Concealed Grid Suspension System: Mineral base acoustical tile support.
   1. Concealed grid upward access suspension system initial opening, 300 mm by 600 mm (12 by 24 inches).
   2. Flange Width: 22 mm (7/8 inch) minimum except:
      a. Access Hook and Angle: 11 mm (7/16 inch) minimum.

D. Suspension System Support of Metal Type V, VI, and VII Tiles: Concealed grid type with runners for snap-in attachment of metal tile (pans).

E. Carrying Channels Secondary Framing: Cold-rolled or hot-rolled steel, black asphaltic paint finish, rust free.
   1. Weight per 300 m (per thousand linear feet), minimum:

Size		Cold-rolled		Hot-rolled	
mm	inches	kg	pound	kg	pound
38	1-1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

F. Anchors and Inserts: Provide anchors or inserts to support twice the loads imposed by hangers.
   1. Hanger Inserts: Steel, zinc-coated (galvanized after fabrication).
      a. Nailing type option for wood forms:
         1) Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).
         2) Lower portion provided with minimum 8 mm (5/16 inch) hole to permit attachment of hangers.
      b. Flush ceiling insert type:
         1) Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
         2) Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
         3) Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.

G. Clips: Galvanized steel, designed to secure framing member in place.

H. Tile Splines: ASTM C635.

I. Wire: ASTM A641.
   1. Size:
      a. Wire Hangers: Minimum diameter 2.68 mm (0.1055 inch).
      b. Bracing Wires: Minimum diameter 3.43 mm (0.1350 inch).

2.6 ACCESSORIES

A. Adhesives: Low pollutant-emitting, water based type recommended by adhered product manufacturer for each application.

B. Perimeter Seal: Vinyl, polyethylene or polyurethane open cell sponge material, density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
   1. Thickness: As required to fill voids between back of wall molding and finish wall.
   2. Size: Minimum 9 mm (3/8 inch) wide strip.

C. Access Identification Markers: Colored markers with pressure sensitive adhesive on one side, paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) diameter.

1. Color Code: Provide the following color markers for service identification:

Color	Service
Red	Sprinkler System: Valves and Controls
Green	Domestic Water: Valves and Controls
Yellow	Chilled Water and Heating Water
Orange	Ductwork: Fire Dampers
Blue	Ductwork: Dampers and Controls
Black	Gas: Laboratory, Medical, Air and Vacuum

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Remove existing acoustical panels or suspension system to permit new installation.

1. Retain existing acoustical panels or suspension system for reuse.
2. Dispose of removed materials if they are damaged during removal or replacement. Contractor shall replace at no additional cost to the station.

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 COR’s consideration.

3.3 ACOUSTICAL UNIT INSTALLATION

A. Applications:

1. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.

B. Layout acoustical unit symmetrically or with minimum number of joints.

C. Installation:

1. Install acoustic tiles after wet finishes have been installed and solvents have cured.

2. Install lay-in acoustic panels in exposed grid with minimum 6 mm (1/4 inch) bearing at edges on supports.
   a. Install tile to lay level and in full contact with exposed grid.
   b. Replace cracked, broken, stained, dirty, or tile.
3. Tile in concealed grid upward access suspension system:
   a. Install acoustical tile with joints close, straight and true to line, and with exposed surfaces level and flush at joints.
   b. Make corners and arises full, and without worn or broken places.
   c. Locate acoustical units providing access to service systems.
4. Adhesive applied tile:
   a. Condition of surface according to ASTM D1779, Note 1, Cleanliness of Surface, and Note 4, Rigidity of Base Surface.
   b. Size or seal surface as recommended by manufacturer of adhesive and allow to dry before installing units.
5. Markers:
   a. Install color coded markers to identify the various concealed piping, mechanical, and plumbing systems.
   b. Attach colored markers to exposed grid on opposite sides of the units providing access.
   c. Attach marker on exposed ceiling surface of upward access acoustical unit.

D. Touch up damaged factory finishes.
   1. Repair painted surfaces with touch up primer.

3.4 CEILING SUSPENSION SYSTEM INSTALLATION

A. General: Install according to ASTM C636.
   1. Use direct or indirect hung suspension system or combination of both.
   2. Support a maximum area of 1.48 sq. m (16 sq. ft.) of ceiling per hanger.
   3. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
   4. Provide additional hangers located at each corner of support components.
   5. Provide minimum 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown.

6. Provide main runners minimum 1200 mm (48 inches) in length.
7. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Direct Hung Suspension System: ASTM C635.
1. Support main runners by hanger wires attached directly to the structure overhead.
2. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

C. Anchorage to Structure:
1. Concrete:
a. Install hanger inserts and wire loops required for support of hanger and bracing wire. Install hanger wires with looped ends through steel deck when steel deck does not have attachment device.
b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.
2. Steel:
a. Install carrying channels for attachment of hanger wires.
1) Size and space carrying channels to support load within performance limit.
2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fireproofing is installed. Weld or use steel clips for beam attachment.
c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

D. Indirect Hung Suspension System: ASTM C635.
1. Space carrying channels for indirect hung suspension system maximum 1200 mm (4 feet) on center. Space hangers for carrying channels

maximum 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) or center so as to insure that specified requirements are not exceeded.

2. Support main runners by specially designed clips attached to carrying channels.

E. Seismic Ceiling Bracing System:

1. Install according to ASTM E580.
2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

3.5 CEILING TREATMENT

A. Moldings:

1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.

B. Perimeter Seal:

1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

C. Existing ceiling:

1. Where extension of existing ceilings occurs, match existing.
2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

D. Fire-Rated System:

1. Total assembly, consisting of the ceiling suspension system, acoustical units, penetrations, structural components and floor or roof construction above, shall have a 3 hour fire rating based on tests conducted in conformance with ASTM E119.

2. Provide concealed fire protection around penetrations in ceilings for electric and mechanical work, and other penetrations as required to maintain the integrity of the fire-rated assembly.
3. Install fire rated ceiling systems to conform to tested assembly.

3.6 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed surfaces. Remove contaminants and stains.

- - - E N D - - -

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:

Prime coats which may be applied in shop under other sections.

1. Prime painting unprimed surfaces to be painted under this Section.
2. 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.
3. Painting ferrous metal (except stainless steel) exposed to view.
4. Painting galvanized ferrous metals exposed to view.
5. Painting interior concrete block 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. Division 22 PLUMBING: Shop prime painting of steel and ferrous metals.

C. Division 23 HEATING; VENTILATION AND AIR-CONDITIONING: Shop prime painting of steel and ferrous metals.

D. Division 26 ELECTRICAL: Shop prime painting of steel and ferrous metals.

E. Division 27 COMMUNICATIONS: 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. Painter qualifications.

C. 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.

D. Sample Panels:

1. After painters' materials have been approved and before work is started, submit sample panels showing each type of finish and color specified.
2. Panels to Show Color: Composition board, 100 x 250 mm (4 x 10 inch).
3. Panel to Show Transparent Finishes: Wood of same species and grain pattern as wood approved for use, 100 x 250 mm (4 x 10 inch face) minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 x 50 mm (2 x 2 inch) minimum or actual wood member to show complete finish.
4. Attach labels to panel stating the following:
   a. Federal Specification Number or manufacturers name and product number of paints used.

b. Product type and color.

c. Name of project.

5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

E. Sample of identity markers if used.

F. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. High temperature aluminum paint.
3. Epoxy coating.
4. Intumescent clear coating or fire-retardant paint.
5. Plastic floor coating.

1.4 DELIVERY AND STORAGE

A. Deliver materials to site in manufacturer's sealed container marked to show following:

1. Name of manufacturer.
2. Product type.
3. Batch number.
4. Instructions for use.
5. Safety precautions.

B. In addition to manufacturer's label, provide a label legibly printed as following:

1. Federal Specification Number, where applicable, and name of material.
2. Surface upon which material is to be applied.
3. Specify Coat Types: Prime; body; finish; etc.

C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.

D. Store materials at site at least 24 hours before using, at a temperature between 7 and 30 degrees C (45 and 85 degrees F).

1.5 QUALITY ASSURANCE

A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.

B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the COR in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

1.6 MOCK-UP PANEL

A. 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.

B. Finish and texture approved by COR will be used as a standard of quality and workmanship for remainder of work.

C. 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.
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. Pressure sensitive adhesive back.

B. Snap on coil plastic markers.

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. Fiber-Cement Board: 12 percent.
   c. Masonry (Clay and CMU's): 12 percent.
   d. Wood: 15 percent.
   e. Gypsum Board: 12 percent.
   f. Plaster: 12 percent.

B. Wood:

1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
   a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
   b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
   a. Thin filler in accordance with manufacturer's instructions for application.
   b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

C. Ferrous Metals:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
   a. Fill flat head countersunk screws used for permanent anchors.
   b. Do not fill screws of item intended for removal such as glazing beads.

4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

D. Zinc-Coated (Galvanized) Metal, Aluminum, Copper and Copper Alloys Surfaces Specified Painted:
1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer) depending on finish coat compatibility.

E. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:
1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
3. Remove loose mortar in masonry work.
4. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three (3) days and brush thoroughly free of crystals.

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: MPI 79 (Marine Alkyd Metal Primer) or MPI 95 (Fast Drying Metal Primer). Use MPI 101 (Cold Curing Epoxy Primer) where MPI

77 (Epoxy Cold Cured, Gloss MPI 98 (High Build Epoxy Coating) or MPI 108 (High Build Epoxy Marine Coating finish is specified.

2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer) or 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) or MPI 95 (Fast Drying Metal Primer).
5. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
6. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel).
7. Asphalt coated metal: MPI 1 (Aluminum Paint).
8. Metal over 94 degrees C (201 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating).

G. Gypsum Board and Hardboard:
1. Surfaces scheduled to have MPI 52 (Interior Latex, MPI Gloss Level 3) or contractor shall match existing finish.
2. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) in shower and bathrooms.

H. Concrete Masonry Units except glazed or integrally colored and decorative units:
1. MPI 4 (Block Filler) on interior surfaces.
2. Prime exterior surface as specified for exterior finishes.

I. Cement Plaster or stucco Concrete Masonry, Brick Masonry and Cement board Interior Surfaces of Ceilings and Walls:
1. MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) or MPI 52 (Interior Latex, MPI Gloss Level 3) or MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) or MPI 114 (Interior Latex, Gloss) except use two (2) coats where substrate has aged less than six (6) months.
2. Use MPI 138 (Interior High Performance Latex, MPI Gloss Level 2) or MPI 139 (Interior High Performance Latex, MPI Gloss level 3) or MPI 140 (Interior High Performance latex, MPI Gloss Level 4) or MPI 141 (Interior High Performance Latex, MPI Gloss Level 5) or MPI 114 (Interior Latex, Gloss) or TT-P-1411A (Paint, Copolymer Resin, Cementitious) Type II or MPI 77 (Epoxy Cold Cured, Gloss or MPI 98 (High Build Epoxy Coating) or MPI 108 (High Build Epoxy Marine Coating) as scheduled.

J. Concrete Floors: MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss) or MPI 60 (Interior/ Exterior Latex Porch & Floor Paint, Low Gloss). MPI 99 (Water-based Acrylic Curing and Sealing Compound).

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) or MPI 11 (Exterior Latex, Semi-Gloss) or 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) or MPI 71 (Polyurethane, Moisture Cured, Clear Flat) for transparent finish.

B. Steel and Ferrous Metal, Including Tern:

1. Two (2) coats of MPI 8 (Exterior Alkyd, Flat) or MPI 9 (Exterior Alkyd Enamel) or MPI 94 (Exterior Alkyd, Semi-Gloss) on exposed surfaces, except on surfaces over 94 degrees C (201 degrees F).
2. One (1) coat of MPI 22 (High Heat Resistant Coating) on surfaces over 94 degrees K (290 degrees F) and on surfaces of boiler, incinerator, stacks or engine exhaust pipes if required.

C. Machinery without factory finish except for primer: One (1) coat MPI 8 (Exterior Alkyd, Flat) or MPI 9 (Exterior Alkyd Enamel) or MPI 94 (Exterior Alkyd, Semi-Gloss).

D. Concrete Masonry Units Brick, Cement Plaster, 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) or 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. One (1) coat of MPI 101 primer over two (2) coats of waterborne light industrial coating MPI 163 on exposed surfaces in battery rooms, pool area, chlorinator rooms. Steel is to be blast cleaned to SSPC 10/NACE No. 2.
   e. Machinery: One (1) coat MPI 9 (Exterior Alkyd Enamel).
   f. Asphalt Coated Metal: One (1) coat MPI 1 (Aluminum Paint).
   g. 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) or 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) or 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) or 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) or MPI 46 (Interior Enamel Undercoat) or MPI 50 (Interior Latex Primer Sealer) plus one (1) coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3).

2. Two (2) coats of MPI 51 (Interior Alkyd, Eggshell).
3. One (1) coat of MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) or MPI 50 (Interior Latex Primer Sealer) plus one (1) coat of 139 (Interior High Performance Latex, MPI Gloss level 3).
4. 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) or MPI 52 (Interior Latex, MPI Gloss Level 3) or MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) or MPI 114 (Interior Latex, Gloss).
3. Two (2) coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2) or MPI 139 (Interior High Performance Latex, MPI Gloss Level 3) or MPI 140 (Interior High Performance Latex MPI Gloss Level 4) or MPI 141 (Interior High Performance Latex MPI Gloss Level 5) or 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) or 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) or 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) or 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) or 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 or 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) or 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) or MPI 31 (Polyurethane Moisture Cured, Clear Gloss).

c. Varnish Finish:

One (1) coat of sealer 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.

Two (2) coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat) or MPI 31 (Polyurethane Moisture Cured, Clear Gloss).

d. Fire Retardant Intumescent Varnish:

MPI 66 (Interior Alkyd Fire Retardant, Clear Top-Coat (UL Approved)) Intumescent Type, Fire Retardant Coating where scheduled: Two (2) coats.

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.

b. Stage Floor: Sand only. No filling, sealing, or waxing is required.

c. Exercise Area, Recreation Hall, Gymnasium, Handball Boards in Exercise Area Floor Finish:

Floor-Sealer Formulation: Pliable, penetrating type, MFMA Group I, Sealers.

Finish-Coat Formulation: Formulated for gloss finish and multicoat application.

Type: MFMA Group 5, Water-Based Finishes.

Allow 48 hours between coats.

Apply in one (1) continuous operation with squeegee or lamb’s wool applicator with application free from streaks in accordance with plastic coating manufacturer's directions.

d. Striping:

Where striping is shown on construction documents for wood floors, apply pressure sensitive adhesive back vinyl plastic tape stripes in widths shown in construction documents.

Do striping when floor coating is dry.

Install stripes to straight lines and true curves.

F. Cement Board: One (1) coat of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2) or MPI 139 (Interior High Performance Latex, MPI Gloss Level 3) or MPI 140 (Interior High Performance Latex MPI Gloss Level 4) or MPI 141 (Interior High Performance Latex, MPI Gloss Level 5 or MPI 114 (Interior Latex, Gloss).

G. Concrete Floors: One (1) coat of MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss).

H. Miscellaneous:

1. MPI 1 (Aluminum Paint): Two (2) coats of aluminum paint.

2. Existing acoustical units scheduled to be repainted except acoustical units with a vinyl finish:

a. Clean units free of dust, dirt, grease, and other deterrents to paint adhesion.

b. Mineral fiber units: One (1) coat of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) or MPI 52 (Interior Latex, MPI Gloss Level 3) or

MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) or MPI 114 (Interior Latex, Gloss).

c. Units of organic fiber or other material not having a class A rating: One (1) coat of MPI 66 (Interior Alkyd Fire Retardant, Clear Top-Coat (UL Approved)) or MPI 67 (Interior Latex Fire Retardant, Top-Coat (UL Approved)) fire retardant paint.

3. Interstitial floor markings: One (1) coat MPI 27 (Exterior/ Interior Alkyd Floor Enamel, Gloss) or MPI 59 ((Interior/ Exterior Alkyd Porch & Floor Enamel, Low Gloss) or MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss) or MPI 60 (interior/ Exterior Latex Porch & Floor Paint, Low Gloss).

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) or 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. For additional requirements regarding color see Articles, "REFINISHING EXISTING PAINTED SURFACE" and "MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE".

B. 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.

C. 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. Paint various systems specified in Division 02 – EXISTING CONDITIONS, Division 22 - PLUMBING, Division 23 – HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, and Division 27 - COMMUNICATIONS.

C. Paint after tests have been completed.

D. Omit prime coat from factory prime-coated items.

E. 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.

F. Omit field painting of items specified in "BUILDING AND STRUCTURAL WORK FIELD PAINTING"; "Building and Structural Work not Painted".

G. Color:

1. Paint items having no color specified to match surrounding surfaces.
2. Paint colors as specified 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.

H. Apply paint systems on properly prepared and primed surface as follows:
1. Exterior Locations:
a. Apply two (2) coats of MPI 8 (Exterior Alkyd, Flat) or MPI 94 (Exterior Alkyd, Semi-gloss) or 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 10 (Exterior Latex, Flat) or MPI 11 (Exterior Latex, Semi-Gloss) or MPI 119 (Exterior Latex, High Gloss (acrylic)) 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. Ferrous metal exposed in hydrotherapy equipment room and chlorinator room of water and sewerage treatment plants: One (1) coat of MPI 101 (Cold Curing Epoxy Primer) and one (1) coat of MPI 77 (Epoxy Cold Cured, Gloss or MPI 98 (High Build Epoxy Coating)) or MPI 108 (High Build Epoxy Marine coating).

c. Apply one (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) or MPI 44 (Interior Low Sheen Latex) or MPI 52 (Interior Latex, MPI Gloss Level 3) or MPI 43 (Interior Satin Latex) or MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) or 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.

d. 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.

e. Paint electrical conduits containing cables rated 600 volts or more using two (2) coats of MPI 9 (Exterior Alkyd Enamel) or MPI 8 (Exterior Alkyd, Flat) or MPI 94 (Exterior Alkyd, Semi-gloss) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.

3. Other exposed locations:

a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two (2) coats of MPI 1 (Aluminum Paint).

b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating

systems: One (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of MPI 10 (Exterior Latex, Flat) or MPI 11 (Exterior Latex Semi-Gloss or MPI 119 (Exterior Latex, High Gloss (acrylic)).

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 of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
   2. Painting of ferrous metal and galvanized metal.
   3. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space (except shingles).
   4. Identity painting and safety painting.

B. Building and Structural Work not Painted:
   1. Prefinished items:
      a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
      b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
   2. Finished surfaces:
      a. Hardware except ferrous metal.
      b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
      c. Signs, fixtures, and other similar items integrally finished.
   3. Concealed surfaces:
      a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
      b. Inside walls or other spaces behind access doors or panels.
      c. Surfaces concealed behind permanently installed casework and equipment.
   4. Moving and operating parts:
      a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
      b. Tracks for overhead or coiling doors, shutters, and grilles.

5. Labels:
   a. Code required label, such as Underwriters Laboratories Inc., Intertek Testing Service or Factory Mutual Research Corporation.
   b. Identification plates, instruction plates, performance rating, and nomenclature.
6. Galvanized metal:
   a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
   b. Gas Storage Racks.
   c. Except where specifically specified to be painted.
7. Metal safety treads and nosings.
8. Gaskets.
9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
10. Face brick.
11. Structural steel encased in concrete, masonry, or other enclosure.
12. Structural steel to receive sprayed-on fire proofing.
13. Ceilings, walls, columns in interstitial spaces.
14. Ceilings, walls, and columns in pipe basements.
15. Wood Shingles.

3.14 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
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Green	White	H.P. _____*
High Pressure Condensate Return		Green	White	H.P. Ret ____*
Medium Pressure Steam		Green	White	M. P. Stm ____*
Medium Pressure Condensate Return		Green	White	M.P. Ret _____*
Low Pressure Steam		Green	White	L.P. Stm _____*
Low Pressure Condensate Return		Green	White	L.P. Ret _____*
High Temperature Water Supply		Green	White	H. Temp Wtr Sup
High Temperature Water Return		Green	White	H. Temp Wtr Ret
Hot Water Heating Supply		Green	White	H. W. Htg Sup
Hot Water Heating Return		Green	White	H. W. Htg Ret
Gravity Condensate Return		Green	White	Gravity Cond Ret
Pumped Condensate Return		Green	White	Pumped Cond Ret
Vacuum Condensate Return		Green	White	Vac Cond Ret
Fuel Oil - Grade (Diesel Fuel included under Fuel Oil)		Brown	White	Fuel Oil-Grade
Boiler Water Sampling		Green	White	Sample

Chemical Feed		Green	White	Chem Feed
Continuous Blow-Down		Green	White	Cont. B D
Pumped Condensate		Green	White	Pump Cond
Pump Recirculating		Green	White	Pump-Recirc.
Vent Line		Green	White	Vent
Alkali		Orange	Black	Alk
Bleach		Orange	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Orange	Black	Acid Waste
Vent		Orange	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler	Red	Red	White	Auto Spr
Standpipe	Red	Red	White	Stand
Sprinkler	Red	Red	White	Drain
Hot Water Supply Dom./				
Solar Water		Green	White	H.W. Sup Dom/SW
Hot Water Return Dom./				
Solar Water		Green	White	H.W. Ret Dom/SW

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the

voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6096 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, 5000 an 15000 an 25000 as appropriate.

8. See Sections for methods of identification, legends, and abbreviations of the following:
   a. Conduits containing high voltage feeders over 600 volts:
      Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS /
      Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

B. Fire and Smoke Partitions:
   1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
   2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
   3. Locate not more than 6096 mm (20 feet) on center on corridor sides of partitions, and with a least one (1) message per room on room side of partition.
   4. Use semi-gloss paint of color that contrasts with color of substrate.

C. Identify columns in pipe basements and interstitial space:
   1. Apply stenciled number and letters to correspond with grid numbering and lettering indicated on construction documents.
   2. Paint numbers and letters 101 mm (4 inches) high, locate 45 mm (18 inches) below overhead structural slab.
   3. Apply on four (4) sides of interior columns and on inside face only of exterior wall columns.
   4. Color:
      a. Use black on concrete columns.
      b. Use white or contrasting color on steel columns.

3.15 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 13 05 41
SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

PART 1 - GENERAL
1.1 DESCRIPTION

A. Provide seismic restraint in accordance with the requirements of the drawings, VA Handbook H18-8: Seismic Design Requirements and this specification in order to maintain the integrity of non-structural components and equipment of the building so that they remain safe and functional in case of seismic event.

B. The design of seismic restraints of non-structural components to resist seismic load shall be based on Seismic Design parameters indicated below in accordance with VA H-18-8 in conjunction with ASCE 7 and ASCE 41, as specified in H-18-8 Section 4.0, for existing building retrofit projects. Specific requirements for Critical and Essential facilities are covered in Section 4.0 of H-18-8, including applying Ip = 1.5 for all nonstructural components in Critical facilities.

1. International Building Code 2018 Edition
2. American Society of Civil Engineers Seismic Evaluation and Retrofit of Existing Buildings ASCE 41-17.
3. American Society of Civil Engineers Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7)7-16
4. Facility Occupancy Category per VA H-18-8: Critical
5. Site Class: D
6. Building Risk Category: IV
7. Mapped MCE_R 0.2 s period Spectral Response Acceleration Parameter (Ss): .396g
8. Mapped MCE_R 1.0 s period Spectral Response Acceleration Parameter (S1): .151g
9. Short period Spectral Response Acceleration Parameter (Sds): .392g
10. Short period Spectral Response Acceleration Parameter (Sd1): .231g
11. Building Seismic Design Category: D
12. Component Importance Factor (Ip): 1.5
13. Component Response Modification Factor (Rp): 6
14. Component Overstrength Factor: 2

C. Definitions: Non-structural building components are components or systems that are not part of the building’s structural system whether

inside or outside, above or below grade. Non-structural components of buildings include but are not limited to (Refer to VA H-18-8, ASCE 7 and ASCE 41 for additional examples):

1. Architectural Elements: Facades that are not part of the structural system and its shear resistant elements; cornices and other architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; stairs isolated from the basic structure; cabinets; bookshelves; medical equipment; and storage racks, etc.
2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems, etc.
3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler/chiller/utility plant/other equipment and components, etc.
4. Transportation Elements: Mechanical, electrical and structural elements for transport systems, i.e., elevators and dumbwaiters, including hoisting equipment and counterweights.

1.2 RELATED WORK

Related specifications include but are not limited to those shown below. Coordinate all work with the applicable specification for that work.

A. Acoustical Ceilings: Section 09 51 00 ACOUSTICAL CEILINGS.

1.3 QUALITY CONTROL

A. Shop-Drawing Preparation:

1. Non-structural seismic restraint systems shop drawings and delegated design calculations shall be prepared by a professional structural engineer with a minimum of 5 years’ experience in the design and detailing of seismic force restraints. The professional structural engineer shall be registered in the state where the project is located and submit qualifications with list of projects illustrating compliance with the experience requirement of this section.
2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State where project is located.

B. Coordination:
   1. Do not install seismic restraints until seismic restraint submittals are approved by the Contracting Officers Representative (COR).
   2. Coordinate trapezes or other multi-pipe hanger systems prior to submission of shop drawings for review.

C. Seismic Certification:
   In structures assigned to Seismic Design Category C, D, E, or F, permanent equipment and components are to have Special Seismic Certification in accordance with requirements of section 13.2.2 of ASCE 7, including those required in existing buildings within Section 13.7.1.3.3, 13.7.7.3.3 and 13.7.8.3.3 of ASCE 41, except for equipment and components that are considered inherently rugged as listed in Section 4.2.2 of VA H18-8, and shall comply with section 13.2.6 of ASCE 7.

1.4 SUBMITTALS

A. Submit a complete and coordinated set of bracing and signed and sealed anchorage drawings and calculations for all non-structural elements requiring seismic restraint by the delegated professional structural engineer mentioned in Section 1.3.A.1 for review prior to installation including:
   1. Description, layout, and location of all items to be anchored or braced with anchorage or brace points noted and dimensioned.
   2. Details of all anchorage and bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified. Details shall be coordinated with all project conditions and trades prior to shop drawing submission for review.
   3. Complete calculations including but not limited to seismic design criteria, computer model input and output, seismic design forces and capacities, design tables and information used for all proprietary design elements such as post installed anchors, stamped and signed by a professional structural engineer specified in section 1.3 A.1.
   4. For all post installed anchorages submit the appropriate International Code Council Engineering Service (ICC-ES) evaluation reports, California’s Office of Statewide Health Planning and Development(OSHPD) pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.

5. Delegated professional structural engineer qualifications.

B. Submit for review prior to installation, the following for seismic protection of piping in addition to items noted in Section 1.4.A:
   1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
   2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
   3. Pipe contents.
   4. Structural framing for the seismic and gravity support and the main superstructure for which the bracing and or anchorage is attached.
   5. Location of all gravity load pipe supports and spacing requirements.
   6. Numerical value of gravity load reactions.
   7. Location of all seismic bracing.
   8. Numerical value of applied seismic brace loads.
   9. Type of connection (Vertical support, vertical support with seismic brace etc.).
   10. Seismic brace reaction type (tension or compression): Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.

C. Submit for review prior to installation, the following items for seismic protection of suspended ductwork and suspended electrical and communication cables, in addition to items noted in Section 1.4.A:
   1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
   2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
   3. Maximum spacing of hangers and bracing.

1.5 APPLICABLE PUBLICATIONS

A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.

B. American Concrete Institute (ACI):
   355.2-19.....Qualification for Post-Installed Mechanical Anchors in Concrete and Commentary

C. American Institute of Steel Construction (AISC):
   Load and Resistance Factor Design, Volume 1, Second Edition

D. ASTM International (ASTM):

A36/A36M-19.....Standard Specification for Carbon Structural Steel

A53/A53M-18.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A307-14e1.....Standard Specifications for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength

A325-14.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A325M-14.....Standard Specification for High-Strength Bolts for Structural Steel Joints [Metric]

A490-14a.....Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength

A490M-14a.....Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]

A500/A500M-18.....Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

A501/A501M-14.....Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A992/A992M-11(2015).....Standard Specification for Steel for Structural Shapes for Use in Building Framing

A996/A996M-16.....Standard Specification for Rail Steel and Axle Steel Deformed Bars for Concrete Reinforcement

E488/E488M-18.....Standard Test Methods for Strength of Anchors in Concrete Elements

E. American Society of Civil Engineers

1. Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7) Edition as indicated in section 1.1 B of this

specification. Associated Criteria for Buildings and Other Structures (ASCE 7): 7-16

F. International Building Code (IBC) Edition as indicated in Section 1.1 B of this specification.

G. VA Handbook H18-8 Seismic Design Requirements, VA H-18-8, November 2019(REVISED MAY 1,2020)

H. National Uniform Seismic Installation Guidelines (NUSIG)

I. Sheet Metal and Air Conditioning Contractors National Association

J. (SMACNA): Seismic Restraint Manual - Guidelines for Mechanical Systems, 3RD EDITION 2008 and Addendum

1.6 REGULATORY REQUIREMENT

A. IBC as shown in Section 1.1 B of this specification.

B. Exceptions: The omission of seismic restraints shall be allowed only in accordance with VA H18-8, ASCE 7 and ASCE 41.

PART 2 - PRODUCTS

2.1 STEEL

A. Structural Steel: ASTM A36.

B. Structural Tubing: ASTM A500, Grade B.

C. Structural Tubing: ASTM A501.

D. Steel Pipe: ASTM A53/A53M, Grade B.

E. Bolts & Nuts: ASTM A325.

PART 3 - EXECUTION

3.1 CONSTRUCTION, GENERAL

A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.

B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.

C. Construct seismic restraints and anchorage to allow for thermal expansion.

D. Testing Before Final Inspection:

1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.

2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.
3. Construct seismic restraints and anchorages to not interfere with other trades or damage existing or in-situ elements of the constructed building.

3.2 EQUIPMENT RESTRAINT AND BRACING

A. See drawings for equipment to be restrained or braced.

3.3 PLUMBING PIPING, ELECTRICAL CIRCUITING, CONDUITS, AND TELECOMMUNICATION WIRES AND CONDUITS.

A. Support and brace plumbing piping, electrical circuiting, conduits and telecommunication wires and conduits to resist directional forces (lateral, longitudinal and vertical).
B. Brace pipe and breeching branches with a minimum of 1 brace per branch.
C. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.
D. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

3.4 CEILINGS

A. At intervals required to meet the seismic demand forces, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.

- - - E N D - - -

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. COR: Contracting Officer’s Representative
32. CPVC: Chlorinated Polyvinyl Chloride
33. CR: Chloroprene
34. CRS: Corrosion Resistant Steel
35. CWP: Cold Working Pressure
36. CxA: Commissioning Agent
37. dB: Decibels
38. db(A): Decibels (A weighted)
39. DCW: Domestic Cold Water
40. DDC: Direct Digital Control
41. DFU: Drainage Fixture Units
42. DHW: Domestic Hot Water
43. DHWR: Domestic Hot Water Return
44. DHWS: Domestic How Water Supply
45. DI: Digital Input
46. DI: Deionized Water
47. DISS: Diameter Index Safety System
48. DN: Diameter Nominal
49. DO: Digital Output
50. DOE: Department of Energy
51. DVD: Digital Video Disc
52. DWG: Drawing
53. DWH: Domestic Water Heater
54. DWS: Domestic Water Supply
55. DWV: Drainage, Waste and Vent
56. ECC: Engineering Control Center
57. EL: Elevation
58. EMCS: Energy Monitoring and Control System
59. EPA: Environmental Protection Agency
60. EPACT: Energy Policy Act
61. EPDM: Ethylene Propylene Diene Monomer
62. EPT: Ethylene Propylene Terpolymer

63. ETO: Ethylene Oxide
64. F: Fahrenheit
65. FAR: Federal Acquisition Regulations
66. FD: Floor Drain
67. FDC: Fire Department (Hose) Connection
68. FED: Federal
69. FG: Fiberglass
70. FNPT: Female National Pipe Thread
71. FOR: Fuel Oil Return
72. FOS: Fuel Oil Supply
73. FOV: Fuel Oil Vent
74. FPM: Fluoroelastomer Polymer
75. FSK: Foil-Scrim-Kraft Facing
76. FSS: VA Construction & Facilities Management, Facility Standards Service
77. FU: Fixture Units
78. GAL: Gallon
79. GCO: Grade Cleanouts
80. GPD: Gallons per Day
81. GPH: Gallons per Hour
82. GPM: Gallons per Minute
83. HDPE: High Density Polyethylene
84. HEFP: Healthcare Environment and Facilities Program (replacement for OCAMES)
85. HEX: Heat Exchanger
86. Hg: Mercury
87. HOA: Hands-Off-Automatic
88. HP: Horsepower
89. HVE: High Volume Evacuation
90. Hz: Hertz
91. ID: Inside Diameter
92. IE: Invert Elevation
93. INV: Invert
94. IPC: International Plumbing Code
95. IPS: Iron Pipe Size
96. IW: Indirect Waste
97. IWH: Instantaneous Water Heater

98. Kg: Kilogram
99. kPa: Kilopascal
100. KW: Kilowatt
101. KWH: Kilowatt Hour
102. lb: Pound
103. lbs/hr: Pounds per Hour
104. LNG: Liquid Natural Gas
105. L/min: Liters per Minute
106. LOX: Liquid Oxygen
107. L/s: Liters per Second
108. m: Meter
109. MA: Medical Air
110. MAWP: Maximum Allowable Working Pressure
111. MAX: Maximum
112. MBH: 1000 Btu per Hour
113. MED: Medical
114. MER: Mechanical Equipment Room
115. MFG: Manufacturer
116. mg: Milligram
117. mg/L: Milligrams per Liter
118. ml: Milliliter
119. mm: Millimeter
120. MIN: Minimum
121. MV: Medical Vacuum
122. N2: Nitrogen
123. N20: Nitrogen Oxide
124. NC: Normally Closed
125. NF: Oil Free Dry (Nitrogen)
126. NG: Natural Gas
127. NIC: Not in Contract
128. NO: Normally Open
129. NOM: Nominal
130. NPTF: National Pipe Thread Female
131. NPS: Nominal Pipe Size
132. NPT: Nominal Pipe Thread
133. NTS: Not to Scale
134. O2: Oxygen

135. OC: On Center
136. OD: Outside Diameter
137. OSD: Open Sight Drain
138. OS&Y: Outside Stem and Yoke
139. PA: Pascal
140. PBPU: Prefabricated Bedside Patient Units
141. PD: Pressure Drop or Difference
142. PDI: Plumbing and Drainage Institute
143. PH: Power of Hydrogen
144. PID: Proportional-Integral-Differential
145. PLC: Programmable Logic Controllers
146. PP: Polypropylene
147. ppb: Parts per Billion
148. ppm: Parts per Million
149. PSI: Pounds per Square Inch
150. PSIA: Pounds per Square Inch Atmosphere
151. PSIG: Pounds per Square Inch Gauge
152. PTFE: Polytetrafluoroethylene
153. PVC: Polyvinyl Chloride
154. PVDF: Polyvinylidene Fluoride
155. RAD: Radians
156. RO: Reverse Osmosis
157. RPM: Revolutions Per Minute
158. RTD: Resistance Temperature Detectors
159. RTRP: Reinforced Thermosetting Resin Pipe
160. SAN: Sanitary Sewer
161. SCFM: Standard Cubic Feet per Minute
162. SDI: Silt Density Index
163. SMACNA: Sheet Metal and Air Conditioning Contractors National Association
164. SPEC: Specification
165. SPS: Sterile Processing Services
166. SQFT/SF: Square Feet
167. SS: Stainless Steel
168. STD: Standard
169. SUS: Saybolt Universal Second
170. SWP: Steam Working Pressure

171. TD: Temperature Difference
172. TDH: Total Dynamic Head
173. TEFC: Totally Enclosed Fan-Cooled
174. TEMP: Temperature
175. TFE: Tetrafluoroethylene
176. THERM: 100,000 Btu
177. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
178. THWN: Thermoplastic Heat & Water Resistant Nylon Coated Wire
179. TIL: Technical Information Library
     http//www.cfm.va.gov/til/indes.asp
180. T/P: Temperature and Pressure
181. TYP: Typical
182. USDA: U.S. Department of Agriculture
183. V: Vent
184. V: Volt
185. VA: Veterans Administration
186. VA CFM: VA Construction & Facilities Management
187. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
188. VAC: Vacuum
189. VAC: Voltage in Alternating Current
190. VAMC: Veterans Administration Medical Center
191. VHA OCAMES: This has been replaced by HEFP.
192. VSD: Variable Speed Drive
193. VTR: Vent through Roof
194. W: Waste
195. WAGD: Waste Anesthesia Gas Disposal
196. WC: Water Closet
197. WG: Water Gauge
198. WOG: Water, Oil, Gas
199. WPD: Water Pressure Drop
200. 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 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

F. Section 07 84 00, FIRESTOPPING.

G. Section 07 92 00, JOINT SEALANTS.

H. Section 09 91 00, PAINTING.

I. Section 22 07 11, PLUMBING INSULATION.

J. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

K. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

L. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

M. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below will form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):

B31.1-2013.....Power Piping

ASME Boiler and Pressure Vessel Code -

BPVC Section IX-2019.... Welding, Brazing, and Fusing Qualifications

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

A36/A36M-2019.....Standard Specification for Carbon Structural Steel

A575-96(2013)e1.....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

E84-2013a.....Standard Test Method for Surface Burning Characteristics of Building Materials

E119-2012a.....Standard Test Methods for Fire Tests of Building Construction and Materials

D. International Code Council, (ICC):

IBC-2018.....International Building Code

IPC-2018.....International Plumbing Code

E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:

SP-58-2018.....Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation

F. Military Specifications (MIL):

P-21035B.....Paint High Zinc Dust Content, Galvanizing Repair (Metric)

G. National Electrical Manufacturers Association (NEMA):

MG 1-2016.....Motors and Generators

H. National Fire Protection Association (NFPA):

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

54-2018.....National Fuel Gas Code

70-2020.....National Electrical Code (NEC)

99-2018.....Healthcare Facilities Code

I. NSF International (NSF):

5-2019.....Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment

14-2019.....Plastic Piping System Components and Related Materials

61-2019.....Drinking Water System Components – Health Effects

372-2016.....Drinking Water System Components – Lead Content

J. Department of Veterans Affairs (VA):

PG-18-102014(R18).....Plumbing Design Manual

PG-18-13-2017(R18).....Barrier Free Design Guide

1.4 SUBMITTALS

A. Submittals, including number of required copies, will be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section will be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.

C. If the project is phased, contractors will submit complete phasing plan/schedule with manpower levels prior to commencing work. The phasing plan will be detailed enough to provide milestones in the process that can be verified.

D. Contractor will make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessable from the floor or

permanent work platform. It is the Contractor’s responsibility to ensure all submittals meet the VA specifications and requirements and it is assumed by the VA that all submittals do meet the VA specifications unless the Contractor has requested a variance in writing and approved by COR prior to the submittal. If at any time during the project it is found that any item does not meet the VA specifications and there was no variance approval the Contractor will correct at no additional cost or time to the Government even if a submittal was approved.

E. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical will be the Contractor’s responsibility to design, supply, and install at no additional cost or time to the Government. VA approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

F. Prior to submitting shop drawings for approval, Contractor will certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

G. Submittals and shop drawings for interdependent items, containing applicable descriptive information, will be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.

H. Manufacturer's Literature and Data including: Manufacturer’s literature will be submitted under the pertinent section rather than under this section.

1. Electric motor data and variable speed drive data will be submitted with the driven equipment.
2. Equipment and materials identification.
3. Firestopping materials.

4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
5. Wall, floor, and ceiling plates.

I. Coordination/Shop Drawings:

1. Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas.
2. The coordination/shop drawings will include plan views, elevations and sections of all systems and will be on a scale of not less than 1:32 (3/8-inch equal to 1 foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings will clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed coordination/shop drawings of all piping and duct systems. The drawings should include all lockout/tagout points for all energy/hazard sources for each piece of equipment. Coordinate lockout/tagout procedures and practices with local VA requirements.
3. Do not install equipment foundations, equipment or piping until coordination/shop drawings have been approved.
4. In addition, for plumbing systems, provide details of the following:
   a. Mechanical equipment rooms.
   b. Interstitial space.
   c. Hangers, inserts, supports, and bracing.
   d. Pipe sleeves.
   e. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

J. Rigging Plan: Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan will include the path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.

K. Plumbing Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.

2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   a. Include complete list indicating all components of the systems.
   b. Include complete diagrams of the internal wiring for each item of equipment.
   c. Diagrams will have their terminals identified to facilitate installation, operation and maintenance.
3. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

L. Provide copies of approved plumbing equipment submittals to the TAB and Commissioning Subcontractor.

M. Completed System Readiness Checklist provided by the CxA and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

N. Submit training plans, trainer qualifications and instructor qualifications in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. Mechanical, electrical, and associated systems will be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems will be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel will be experienced and qualified specialists in industrial and institutional plumbing.

B. Products Criteria:
   1. Standard Products: Material and equipment will be the standard products of a manufacturer regularly engaged in the manufacture, supply and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, will be the current

generation of technology and basic design that has a proven satisfactory service record of at least 5 years.

2. Equipment Service: There will be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations will come to the site and provide acceptable service to restore operations within 4 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, compressors, water heaters, critical instrumentation, computer workstation and programming will be submitted for project record and inserted into the operations and maintenance manual.
3. All items furnished will be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 22 will conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official will be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code will apply. Any conflicts will be brought to the attention of the COR.
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units will be of the same manufacturer and model number, or if different models are required they will be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit will be the responsibility of the manufacturer of the completed assembly.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark will be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

8. Asbestos products or equipment or materials containing asbestos is prohibited.
9. Bio-Based Materials: For products designated by the USDA's bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

C. Welding: Before any welding is performed, Contractor will submit a certificate certifying that welders comply with the following requirements:
   1. Qualify welding processes and operators for piping according to ASME BPVC, Section IX, "Welding and Brazing Qualifications". Provide proof of current certification to CO.
   2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
   3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
   4. All welds will be stamped according to the provisions of the AWS or ASME as required herein and by the association code.

D. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations will be furnished to the COR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

E. Execution (Installation, Construction) Quality:
   1. All items will be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents will be referred to the COR for resolution. Printed copies or electronic files of manufacturer's installation instructions will be provided to the COR at least 10 working days prior to commencing installation of any item.

2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, will be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to COR for resolution. Failure of the Contractor to resolve or call attention to any discrepancies or deficiencies to the COR will result in the Contractor correcting at no additional cost or time to the Government.
3. Complete layout drawings will be required by Paragraph, SUBMITTALS. Construction work will not start on any system until the layout drawings have been approved by VA.
4. Installer Qualifications: Installer will be licensed and will provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade.
5. Workmanship/craftsmanship will be of the highest quality and standards. The VA reserves the right to reject any work based on poor quality of workmanship this work will be removed and done again at no additional cost or time to the Government.

F. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.
G. Guaranty: Warranty of Construction, FAR clause 52.246-21.
H. Plumbing Systems: IPC, International Plumbing Code. Unless otherwise required herein, perform plumbing work in accordance with the latest version of the IPC. For IPC codes referenced in the contract documents, advisory provisions will be considered mandatory, the word “should” will be interpreted as “will”. Reference to the “code official” or “owner” will be interpreted to mean the COR.
I. Cleanliness of Piping and Equipment Systems:
1. Care will be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping will be removed.

2. Piping systems will be flushed, blown or pigged as necessary to deliver clean systems.
3. The interior of all tanks will be cleaned prior to delivery and beneficial use by the Government. All piping will be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets will be flushed of debris prior to final acceptance.
4. Contractor will be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:
1. Equipment and material placed on the job site will remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.
2. Damaged equipment will be replaced with an identical unit as determined and directed by the COR. Such replacement will be at no additional cost or additional time to the Government.
3. Interiors of new equipment and piping systems will be protected against entry of foreign matter. Both inside and outside will be cleaned before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor will be under the custody and responsibility of the Contractor and will be protected as required for new work.
5. Protect plastic piping and tanks from ultraviolet light (sunlight) while in pre-construction. Plastic piping and tanks will not be installed exposed to sunlight without metal jacketing to block ultraviolet rays.

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.
B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions will be in electronic version 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 owner will be required to employ will be inserted into the As-Built documentation.

C. The installing Contractor will maintain as-built drawings of each completed phase for verification; and, will provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it will not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
   1. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.
   2. As-built drawings are to be provided, with a copy of them on AutoCAD version specified by the station provided on CD or DVD. The CAD drawings will use multiple line layers with a separate individual layer for each system.

D. The as-built drawings will indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation will be provided to COR 21 working days prior to submitting the request for final inspection. The documentation will include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results will contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results will include all readings, including but not limited to data on device

(make, model and performance characteristics_), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.8 JOB CONDITIONS – WORK IN EXISTING BUILDING

A. Building Operation: Government employees will be continuously operating and managing all facilities, including temporary facilities that serve the VAMC.

B. Maintenance of Service: Schedule all work to permit continuous service as required by the VAMC.

C. Steam and Condensate Service Interruptions: Limited steam and condensate service interruptions, as required for interconnections of new and existing systems, will be permitted by the COR during periods when the demands are not critical to the operation of the VAMC. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least 10 working days advance notice to the COR. The request will include a detailed plan on the proposed shutdown and the intended work to be done along with manpower levels. All equipment and materials must be onsite and verified with plan 5 work days prior to the shutdown or it will need to be rescheduled.

D. Phasing of Work: Comply with all requirements shown on contract documents. Contractor will submit a complete detailed phasing plan/schedule with manpower levels prior to commencing work. The phasing plan will be detailed enough to provide milestones in the process that can be verified.

E. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA. Maintain all egress routes and safety systems/devices.

F. Acceptance of Work for Government Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Government, inspections and tests will

be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the COR will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

G. Temporary Facilities: Refer to Paragraph, TEMPORARY PIPING AND EQUIPMENT in this section.

PART 2 - PRODUCTS

2.1 MATERIALS FOR VARIOUS SERVICES

A. Steel pipe will contain a minimum of 25 percent recycled content.

B. Plastic pipe, fittings and solvent cement will meet NSF 14 and will bear the NSF seal "NSF-PW". Polypropylene pipe and fittings will comply with NSF 14 and NSF 61. Solder or flux containing lead will not be used with copper pipe.

C. Material or equipment containing a weighted average of greater than 0.25 percent lead will not be used in any potable water system intended for human consumption and will be certified in accordance with NSF 61 or NSF 372.

D. In-line devices such as water meters, building valves, check valves, stops, valves, fittings, tanks and backflow preventers will comply with NSF 61 and NSF 372.

E. End point devices such as drinking fountains, lavatory faucets, kitchen and bar faucets, ice makers supply stops, and end-point control valves used to dispense drinking water must meet requirements of NSF 61 and NSF 372.

2.2 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components will be maximized to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others will assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike will be products of a single manufacturer.
3. Components will be compatible with each other and with the total assembly for intended service.
4. Contractor will guarantee performance of assemblies of components and will repair or replace elements of the assemblies as required to

deliver specified performance of the complete assembly at no additional cost or time to the Government.

C. Components of equipment will bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, will be the same make and model.

2.3 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed will be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.4 SAFETY GUARDS

A. Pump shafts and couplings will be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material will be minimum 16-gauge sheet steel; ends will be braked and drilled and attached to pump base with minimum of four 8 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

B. All Equipment will have moving parts protected from personal injury.

2.5 LIFTING ATTACHMENTS

A. Equipment will be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments will withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.6 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

A. All material and equipment furnished and installation methods used will conform to the requirements of Section 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. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal pumps may be split phase or permanent split capacitor (PSC).

D. 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.

E. 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.

F. 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 for specifications.

B. The combination of controller and motor will be provided by the respective pump manufacturer and will be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. pumps, will be product of a single manufacturer.

C. Motors will be premium efficient type, “invertor duty”, and be approved by the motor controller manufacturer. The controller-motor combination will be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor sheaves will be fixed pitch.

D. Controller will not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor will be affected from other devices on the AC power system.

2.8 EQUIPMENT AND MATERIALS IDENTIFICATION

A. 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. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 7 mm (3/16 inch) high riveted or bolted to the equipment.

D. 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.

E. Valve Tags and Lists:

1. Plumbing: All valves will be provided with valve tags and listed on a valve list (Fixture stops not included).
2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm

(1/4 inch) for service designation on 19 gauge, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.

3. Valve lists: Valve lists will be created using a word processing program and printed on plastic coated cards. The plastic-coated valve list card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) will show valve tag number, valve function and area of control for each service or system. The valve list will be in a punched 3-ring binder notebook. An additional copy of the valve list will be mounted in picture frames for mounting to a wall. COR will instruct Contractor where frames will be mounted.
4. A detailed plan for each floor of the building indicating the location and valve number for each valve will be provided in the 3-ring binder notebook. Each valve location will be identified with a color-coded sticker or thumb tack in ceiling or access door.

2.9 FIRESTOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping. Refer to Section 22 07 11, PLUMBING INSULATION, for pipe insulation.

2.10 GALVANIZED REPAIR COMPOUND

A. Mil. Spec. DOD-P-21035B, paint.

2.11 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC) and Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Submittals based on the International Building Code (IBC) and Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS requirements, or the following paragraphs of this Section will be stamped and signed by a professional engineer registered in the state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) will be submitted for approval of the COR in all cases. See the above specifications for lateral force design requirements.
B. Type Numbers Specified: For materials, design, manufacture, selection, application, and installation refer to MSS SP-58.
C. For Attachment to Concrete Construction:
   1. Concrete insert: Type 18, MSS SP-58.

2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.

D. For Attachment to Steel Construction: MSS SP-58.
1. Welded attachment: Type 22.
2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.

E. For Attachment to Wood Construction: Wood screws or lag bolts.

F. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles will provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

G. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 43 mm by 43 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gauge), designed to accept special spring held, hardened steel nuts.
1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 8 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

H. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.
1. General Types (MSS SP-58):
a. Standard clevis hanger: Type 1; provide locknut.
b. Riser clamps: Type 8.
c. Wall brackets: Types 31, 32 or 33.

d. Roller supports: Type 41, 43, 44 and 46.

e. Saddle support: Type 36, 37 or 38.

f. Turnbuckle: Types 13 or 15.

g. U-bolt clamp: Type 24.

h. Copper Tube:

1) Hangers, clamps and other support material in contact with tubing will be painted with copper colored epoxy paint, copper-coated, plastic coated or taped with isolation tape to prevent electrolysis.

2) For vertical runs use epoxy painted, copper-coated or plastic coated riser clamps.

3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.

4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending 1 inch beyond steel support or clamp. Spring Supports (Expansion and contraction of vertical piping):

1) Movement up to 20 mm (3/4 inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.

2) Movement more than 20 mm (3/4 inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.

j. Spring hangers are required on all plumbing system pumps one horsepower and greater.

2. Plumbing Piping (Other Than General Types):

a. Horizontal piping: Type 1, 5, 7, 9, and 10.

b. Chrome plated piping: Chrome plated supports.

c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.

d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gauge) minimum.

I. Pre-insulated Calcium Silicate Shields:

1. Provide 360-degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.
2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
3. Shield thickness will match the pipe insulation.
4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
   a. Shields for supporting cold water will have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal.
   b. The insulated calcium silicate shield will support the maximum allowable water filled span as indicated in MSS SP-58. To support the load, the shields will have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.
5. Shields may be used on steel clevis hanger type supports, trapeze hangers, roller supports or flat surfaces.

J. Seismic Restraint of Piping: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

2.12 PIPE PENETRATIONS

A. Pipe penetration sleeves will be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.

B. Pipe penetration sleeve materials will comply with all firestopping requirements for each penetration.

C. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

D. Penetrations are prohibited through beams or ribs, but may be installed in concrete beam flanges, with structural engineer prior approval. Any deviation from these requirements must receive prior approval of COR.

E. Sheet metal, plastic, or moisture resistant fiber sleeves will be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

F. Cast iron or zinc coated pipe sleeves will be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe will be made watertight with a modular or link rubber seal. The link seal will be applied at both ends of the sleeve.

G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves will be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve will be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves will be connected with a floor plate.

H. Brass Pipe Sleeves will be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve will be connected with a floor plate.

I. Sleeve clearance through floors, walls, partitions, and beam flanges will be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation will be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings will be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water and gases.

J. Sealant and Adhesives: Will be as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials will be utilized when possible.

K. Pipe passing through roof will be installed through a 4.9 kg per square meter copper flashing with an integral skirt or flange. Skirt or flange will extend not less than 200 mm (8 inches) from the pipe and set in a solid coating of bituminous cement. Extend flashing a minimum of 250 mm (10 inches) up the pipe. Pipe passing through a waterproofing membrane will be provided with a clamping flange. The annular space between the sleeve and pipe will be sealed watertight.

2.13 TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the COR.

D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials will be utilized when possible.

2.14 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 75 mm (3 inch) pipe, 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates will be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint will be provided in spaces where brass or steel pipe sleeves are specified.

2.15 ASBESTOS

A. Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions will be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment will be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings will be prepared to coordinate proper location and personnel access of all facilities. The drawings will be submitted for review.

B. Manufacturer's published recommendations will be followed for installation methods not otherwise specified.

C. Operating Personnel Access and Observation Provisions: All equipment and systems will be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, but not limited to: all equipment items, valves, backflow preventers, filters, strainers, transmitters, sensors, meters and control devices. All gauges and indicators will be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown in the drawings will not be changed nor reduced.

D. Structural systems necessary for pipe and equipment support will be coordinated to permit proper installation.

E. Location of pipe sleeves, trenches and chases will be accurately coordinated with equipment and piping locations.

F. Cutting Holes:

1. Holes will be located to avoid interference with structural members such as beams or grade beams. Holes will be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter will be referred to COR for approval.
2. Waterproof membrane will not be penetrated. Pipe floor penetration block outs will be provided outside the extents of the waterproof membrane.
3. Holes through concrete and masonry will be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COR where working area space is limited.

G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other services are not shown but must be provided.

H. Protection and Cleaning:

1. Equipment and materials will be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the

opinion of the COR, will be replaced at no additional cost or time to the Government.

2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures will be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. 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.

J. 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.

K. 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.

L. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.

M. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.

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.
4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LUBRICATION

A. All equipment and devices requiring lubrication will be lubricated prior to initial operation. All devices and equipment will be field checked for proper lubrication.

B. All devices and equipment will be equipped with required lubrication fittings. A minimum of 1 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application will be provided. All materials will be delivered to COR in unopened containers that are properly identified as to application.

C. A separate grease gun with attachments for applicable fittings will be provided for each type of grease applied.

D. All lubrication points will be accessible without disassembling equipment, except to remove access plates.

E. All lubrication points will be extended to one side of the equipment.

3.6 PLUMBING SYSTEMS DEMOLITION

A. Rigging access, other than indicated in the drawings, will be provided after approval for structural integrity by the COR. Such access will be provided at no additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris will be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating plant, cleanliness and safety will be maintained. The plant will be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work will be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris will not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting will be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities will be available at all times. All work will be performed in accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel of the VAMC, and the Contractor will follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work will be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings will be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system will be maintained. Reference will also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. All valves including gate, globe, ball, butterfly and check, all pressure gauges and thermometers with wells will remain Government property and will be removed and delivered to COR and stored as

directed. The Contractor will remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material will be removed from Government property expeditiously and will not be allowed to accumulate. Coordinate with the COR and Infection Control.

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

3.7 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems will be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning will be thorough. Solvents, cleaning materials and methods recommended by the manufacturers will be used for the specific tasks. All rust will be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions will be repaired prior to applying prime and finish coats.
2. The following Material and Equipment will NOT be painted:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.
   h. Valve stems and rotating shafts.
   i. Pressure gauges and thermometers.
   j. Glass.
   k. Name plates.
3. Control and instrument panels will be cleaned and damaged surfaces repaired. Touch-up painting will be made with matching paint type and color obtained from manufacturer or computer matched.
4. Pumps, motors, steel and cast-iron bases, and coupling guards will be cleaned, and will be touched-up with the same paint type and color as utilized by the pump manufacturer.

5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats per Section 09 91 00, Painting.
6. The final result will be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment will be repainted, if necessary, to achieve this. Lead based paints will not be used.

3.8 IDENTIFICATION SIGNS

A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, will be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols will correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, and performance data will be placed on factory-built equipment.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.9 STARTUP AND TEMPORARY OPERATION

A. Startup of equipment will be performed as described in the equipment specifications. Vibration within specified tolerance will be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

B. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR 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.

D. Perform tests as required for commissioning provisions in accordance with Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS and Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

3.11 OPERATION AND MAINTENANCE MANUALS

A. All new and temporary equipment and all elements of each assembly will be included.

B. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information will be included.

C. Manufacturer’s installation, maintenance, repair, and operation instructions for each device will be included. Assembly drawings and parts lists will also be included. A summary of operating precautions and reasons for precautions will be included in the Operations and Maintenance Manual.

D. Lubrication instructions, type and quantity of lubricant will be included.

E. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications will be included.

F. Set points of all interlock devices will be listed.

G. Trouble-shooting guide for the control system troubleshooting will be inserted into the Operations and Maintenance Manual.

H. The control system sequence of operation corrected with submittal review comments will be inserted into the Operations and Maintenance Manual.

I. Emergency procedures for shutdown and startup of equipment and systems.

3.12 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.13 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

- - - E N D - - -

SECTION 22 05 19
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for water meters and gauges primarily used for troubleshooting the system and to indicate system performance.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

C. Components intended to be connected to BAS shall be furnished under Section 23 09 23 DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC for installation under this section.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

C. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

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

E. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS. Requirements for commissioning, systems readiness checklist, and training.

F. Section 23 09 23, DIRECT DIGITAL CONTROL SYSTEMS FOR HAVC.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):

B40.100-2013.....Pressure Gauges and Gauge Attachments

B40.200-2008.....Thermometers, Direct Reading and Remote Reading

C. American Water Works Association (AWWA):

C700-2015.....Cold Water Meters, Displacement Type, Bronze Main Case

C701-2015.....Cold Water Meters-Turbine Type, for Customer Service

C702-20115.....Cold Water Meters – Compound Type

C707-2010 (R2016).....Encoder-Type Remote-Registration Systems for Cold-Water Meters

D. Institute of Electrical and Electronics Engineers (IEEE):

C2-2017.....National Electrical Safety Code (NESC)

E. International Code Council (ICC):

IPC-2018.....International Plumbing Code

F. National Fire Protection Association (NFPA):

70-2020.....National Electrical Code (NEC)

G. NSF International (NSF):

61-2019.....Drinking Water System Components - Health Effects

372-2016.....Drinking Water System Components - Lead Content

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 19, METERS AND GAUGES FOR PLUMBING PIPING", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Water Meter.
2. Pressure Gauges.
3. Thermometers.
4. Product certificates for each type of meter and gauge.
5. BACnet communication protocol.

D. Complete operating and maintenance manual shall including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the system.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

E. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the

date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

F. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph "AS-BUILT DOCUMENTATION" of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 DISPLACEMENT WATER METER

A. For pipe sizes 50 mm (2 inches) and smaller, the water meter shall be displacement type, full size nutating disc, magnetic drive, sealed register, and fully conform to AWWA C700. Peak domestic flow shall be 2.2 L/s (34 gpm). The meter register shall indicate flow in liters (U.S. gallons).

B. The water meter shall be rated for use at temperatures ranging from -40 degrees C (-40 degrees F) and 70 degrees C (158 degrees F) and operate at a working pressure of 1035 kPa (150 psig).

C. The meter case, bottom caps, and register box lids shall be constructed from cast bronze.

D. The meter shall register plus or minus 3 percent of the water actually passing through it at any rate of flow within the normal test flow limits specified in AWWA 700.

E. The water meter shall conform to NSF 61 and NSF 372.

2.2 TURBINE WATER METER

A. The water meter shall be Turbine type, Class II, in-line, horizontal axis, and fully conform to AWWA C701. Peak domestic flow shall be 11L/s (180 gpm). The meter Register shall indicate flow in liters (U.S. gallons).

B. The water meter shall be rated for use at temperatures ranging from -40 degrees C (-40 degrees F) and 70 degrees C (158 degrees F) and operate at a working pressure of 1035 kPa (150 psig).

C. The turbine case shall be constructed of cast bronze.

D. The register box rings and lid shall be made of cast copper alloy containing not less than 75 percent copper. Forged or die cast copper alloy containing not less than 75 percent copper or a suitable synthetic polymer.

E. The flow measuring turbine shall be made of a suitable synthetic polymer with specific gravity approximately equal to that of water. The measuring turbine shall have sufficient dimensional stability to retain operating clearances at the full range of working temperatures.

F. All external case closures, such as rings, clamps, screws, bolts, cap bolts, nuts and washers shall be designed for easy removal following lengthy service.

G. The turbine meter shall have flanged ends and supplied with companion flanges, gaskets, and with bolts and nuts. The companion flanges shall be made of cast iron.

H. The meter shall register plus or minus 3 percent of the water actually passing through it at any rate of flow within the normal test flow limits specified in AWWA 701.

I. The water meter shall conform to NSF 61 and NSF 372.

2.3 WATER METER STRAINER

A. All meters shall be fitted with a factory installed integral strainer or bronze inlet strainer with top access. The strainer shall conform to AWWA C702.

B. The water meter strainer shall conform to NSF 61 and NSF 372.

2.4 WATER METER PROGRAMMING

A. All meters 50 mm or DN 50 (2 inches) and greater shall be programmable with software supplied by the meter manufacturer.

B. The software shall have a Microsoft based interface and operate on the latest Windows operating system. The software shall allow the user to configure the meter, troubleshoot the meter, query and display meter parameters, and configure data and stored values.

C. The meter firmware shall be upgradeable through one of the communication ports without removing the unit from service.

D. The meter shall include output for analog 4-20 milliamp signals and binary output.

E. The meter shall have two dry contact relays outputs for alarm or control functions.

2.5 WATER METER COMMUNICATION PROTOCOL

A. The meter shall use a native BACnet Ethernet communication protocol supporting HTTP or SMTP or Modbus based on existing configuration. The communications shall be protected against surges induced on its communications channels. Contractor shall retain Controls Solutions

North West (CSN)for all connection and integration into existing Building Management system. Contact Name: Michael Layman Phone: 509-892-1121 Email: mlayman@csnw.net.

2.6 REMOTE READOUT REGISTER

A. All meters shall be equipped with a remote readout register in accordance with AWWA C707.

2.7 PRESSURE GAUGES FOR WATER AND SEWAGE USAGE

A. ASME B40.100 all metal case 115 mm (4-1/2 inches) diameter, bottom connected throughout, graduated as required for service, and identity labeled. Range shall be 0 to 1380 kPa (0 to 200 psig) gauge.

B. The pressure element assembly shall be bourdon tube. The mechanical movement shall be lined to pressure element and connected to pointer.

C. The dial shall be non-reflective aluminum with permanently etched scale markings graduated in kPa and psig.

D. The pointer shall be dark colored metal.

E. The window shall be glass.

F. The ring shall be brass or stainless steel.

G. The accuracy shall be grade A, plus or minus 1 percent of middle half of scale range.

H. The pressure gauge for water domestic use shall conform to NSF 61 and NSF 372.

2.8 THERMOMETERS

A. Thermometers shall be straight stem, metal case, red liquid-filled thermometer, approximately 175 mm (7 inches) high, 4 degrees C to 100 degrees C (40 degrees F to 212 degrees F). Thermometers shall comply with ASME B40.200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Direct mounted pressure gauges shall be installed in piping tees with pressure gauge located on pipe at the most readable position.

B. Valves and snubbers shall be installed in piping for each pressure gauge.

C. Test plugs shall be installed on the inlet and outlet pipes of all heat exchangers or water heaters serving more than one plumbing fixture.

D. Pressure gauges shall be installed where indicated in the drawings and at the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure reducing valve.

3. Suction and discharge of each domestic water pump or re-circulating hot water return pump.

E. Water meter installation shall conform to AWWA C700, AWWA C701, and AWWA C702. Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein. New materials shall be provided.

F. Remote readout register shall be mounted at the location indicated in the drawings or as directed by the COR.

G. Thermometers shall be installed on the water heater inlet and outlet piping, thermostatic mixing valve outlet piping, and the hot water circulation pump inlet piping.

H. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

I. Install portable water temperature, pressure and flow meters provided under Section 23 09 23 DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

3.2 FIELD QUALITY CONTROL

A. The meter assembly shall be visually inspected and operationally tested. The correct multiplier placement on the face of the meter shall be verified.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

- - - E N D - - -

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 91 00, GENERAL COMMISSIONING REQUIREMENTS.

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

E. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):
A112.14.1-2003.....Backwater Valves

C. American Society of Sanitary Engineering (ASSE):
1001-2017.....Performance Requirements for Atmospheric Type Vacuum Breakers
1003-2009.....Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems
1011-2017.....Performance Requirements for Hose Connection Vacuum Breakers
1013-2011.....Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers
1015-2011.....Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies

1017-2009.....Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems

1020-2004.....Performance Requirements for Pressure Vacuum Breaker Assembly

1035-2008.....Performance Requirements for Laboratory Faucet Backflow Preventers

1069-2005.....Performance Requirements for Automatic Temperature Control Mixing Valves

1070-2015.....Performance Requirements for Water Temperature Limiting Devices

1071-2012.....Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment

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

A126-2004(R2019).....Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A276/A276M-2017.....Standard Specification for Stainless Steel Bars and Shapes

A536-1984(R2019e).....Standard Specification for Ductile Iron Castings

B62-2017.....Standard Specification for Composition Bronze or Ounce Metal Castings

B584-2014.....Standard Specification for Copper Alloy Sand Castings for General Applications

E. International Code Council (ICC):

IPC-2018.....International Plumbing Code

F. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-25-2018.....Standard Marking Systems for Valves, Fittings, Flanges and Unions

SP-67-2017.....Butterfly Valves

SP-70-2011.....Gray Iron Gate Valves, Flanged and Threaded Ends

SP-71-2018.....Gray Iron Swing Check Valves, Flanged and Threaded Ends

SP-80-2019.....Bronze Gate, Globe, Angle, and Check Valves

SP-85-2011.....Gray Iron Globe & Angle Valves, Flanged and Threaded Ends

SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

G. National Environmental Balancing Bureau (NEBB):

8th Edition 2015 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

H. NSF International (NSF):

61-2019.....Drinking Water System Components – Health Effects

372-2016.....Drinking Water System Components – Lead Content

I. University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USC FCCCHR):

10th Edition.....Manual of Cross-Connection Control

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Ball Valves.
2. Gate Valves.
3. Butterfly Valves.
4. Balancing Valves.
5. Check Valves.
6. Globe Valves.
7. Water Pressure Reducing Valves and Connections.
8. Backwater Valves.
9. Backflow Preventers.
10. Chainwheels.
11. Thermostatic Mixing Valves.

D. Test and Balance reports for balancing valves.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
   4. Piping diagrams of thermostatic mixing valves to be installed.

F. Completed System Readiness Checklist provided by the CxA and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

G. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Valves shall be prepared for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set angle, gate, and globe valves closed to prevent rattling.
   4. Set ball and plug valves open to minimize exposure of functional surfaces.
   5. Set butterfly valves closed or slightly open.
   6. Block check valves in either closed or open position.

B. Valves shall be prepared for storage as follows:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature.

C. A sling shall be used for large valves. The sling shall be rigged to avoid damage to exposed parts. Hand wheels or stems shall not be used as lifting or rigging points.

1.6 AS BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

A. Asbestos packing and gaskets are prohibited.

B. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing greater than 15 percent zinc shall not be permitted.

C. Valves in insulated piping shall have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.

D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 m (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.

E. All valves used to supply potable water shall meet the requirements of NSF 61 and NSF 372.

F. Bio-Based Materials: For products designated by the USDA's bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

2.2 SHUT-OFF VALVES

A. Cold, Hot and Re-circulating Hot Water:

1. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-110, Ball valve shall be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4138 kPa (600 psig). The body material shall be Bronze ASTM B584. The ends shall be non-lead solder.
2. Less than 100 mm DN100 (4 inches): Butterfly shall have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a SWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure. The body material shall meet ASTM A536, ductile iron.
3. 100 mm DN100 (4 inches) and greater:
   a. Class 125, OS&Y, Cast Iron Gate Valve. The gate valve shall meet MSS SP-70 type I standard. The gate valve shall have a CWP rating of 1380 kPa (200 psig). The valve materials shall meet ASTM A126,

grey iron with bolted bonnet, flanged ends, bronze trim, and positive-seal resilient solid wedge disc. The gate valve shall be gear operated for sizes under 200 mm or DN200 (8 inches) and crank operated for sizes 200 mm or DN200 (8 inches) and greater.

b. Single flange, ductile iron butterfly valves: The single flanged butterfly valve shall meet the MSS SP-67 standard. The butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The butterfly valve shall be lug type, suitable for bidirectional dead-end service at rated pressure without use of downstream flange. The body material shall comply with ASTM A536 ductile iron. The seat shall be EPDM with stainless steel disc and stem.

c. Grooved end, ductile iron butterfly valves. The grooved butterfly valve shall meet the MSS SP-67 standard. The grooved butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The valve materials shall be epoxy coated ductile iron conforming to ASTM A536 with two-piece stainless-steel stem, Buna-N or EPDM encapsulated ductile iron disc, and EPDM seal. The butterfly valve shall be gear operated.

B. Reagent Grade Water: Valves for reagent grade, reverse osmosis, or deionized water service shall be ball type of same material as used for pipe.

2.3 GLOBE VALVES

A. 75 mm or DN75 (3 inches) or smaller: Class 150, bronze globe valve with non-metallic disc. The globe valve shall meet MSS SP-80, Type 2 standard. The globe valve shall have a CWP rating of 2070 kPa (300 psig). The valve material shall be bronze with integral seal and union ring bonnet conforming to ASTM B62 with solder ends, copper-silicon bronze stem, PTFE or TFE disc, and malleable iron hand wheel.

B. Greater than 75 mm or DN75 (3 inches): Similar to above, except with cast iron body and bronze trim, Class 125, iron globe valve. The globe valve shall meet MSS SP-85, Type 1 standard. The globe valve shall have a CWP rating of 1380 kPa (200 psig). The valve material shall be gray iron with bolted bonnet conforming to ASTM A126 with flanged ends, bronze trim, and malleable iron handwheel.

2.4 WATER PRESSURE REDUCING VALVE AND CONNECTIONS

A. 75 mm or DN75 (3 inches) or smaller: The pressure reducing valve shall consist of a bronze body and bell housing, a separate access cover for

the plunger, and a bolt to adjust the downstream pressure. The pressure reducing valve shall meet ASSE 1003. The bronze bell housing and access cap shall be threaded to the body and shall not require the use of ferrous screws. The assembly shall be of the balanced piston design and shall reduce pressure in both flow and no flow conditions. The assembly shall be accessible for maintenance without having to remove the body from the line.

B. 100 mm or DN100 (4 inches) and greater: The pressure reducing valve shall consist of a flanged cast iron body and rated to 1380 kPa (200 psig). The valve shall have a large elastomer diaphragm for sensitive response. The pressure reducing valve shall meet ASSE 1003.

C. The regulator shall have a tap for pressure gauge.

D. The regulator shall have a temperature rating of 100 degrees C (212 degrees F) for hot water or hot water return service. Pressure regulators shall have accurate pressure regulation to 6.9 kPa (+/- 1 psig).

E. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.

F. Connections Valves and Strainers: Shut off valves shall be installed on each side of reducing valve and a bypass line equal in size to the regulator inlet pipe shall be installed with a normally closed globe valve. A strainer shall be installed on inlet side of, and same size as pressure reducing valve. A pressure gauge shall be installed on the inlet and outlet of the valve.

2.5 BACKFLOW PREVENTERS

A. A backflow prevention assembly shall be installed at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. The backflow prevention assembly shall be approved by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USCFCCC).

B. The reduced pressure principle backflow prevention assembly shall be ASSE listed 1013 with full port OS&Y positive-seal resilient gate valves and an integral relief monitor switch. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade 4. The seat ring and check valve shall be the thermoplastic type suited for water service. The stem shall be stainless steel conforming to ASTM A276/A276M. The seat disc shall be the elastomer type suited for water

service. The checks and the relief valve shall be accessible for maintenance without removing the device from the line. An epoxy coated wye type strainer with flanged connections shall be installed on the inlet. Reduced pressure backflow preventers shall be installed in the following applications.

1. Deionizers.
2. Sterilizers.
3. Dialysis, Deionized or Reverse Osmosis Water Systems.
4. Water make up to heating systems, cooling tower, chilled water system, generators, and similar equipment consuming water.
5. Water service entrance from loop system.
6. Dental equipment.
7. Power washer.
8. Medical equipment.
9. Process equipment.
10. Autopsy, on each hot and cold water outlet at each table or sink.
11. Reclaimed water systems.

C. The pipe applied or integral atmospheric vacuum breaker shall be ASSE listed 1001. The main body shall be cast bronze. The seat disc shall be the elastomer type suited for water service. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable. Atmospheric vacuum breakers shall be installed in the following applications.

1. Hose bibs and sinks with threaded outlets.
2. Disposers.
3. Showers (telephone/handheld type).
4. Hydrotherapy units.
5. All kitchen equipment, if not protected by air gap.
6. Ventilating hoods with wash down system.
7. Film processor.
8. Detergent system.
9. Fume hoods.
10. Glassware washers.
11. Service sinks (integral with faucet only).
12. Laundry tubs (integral with faucet only).

13. Sitz baths.

D. The hose connection vacuum breaker shall be ASSE listed 1011. The main body shall be cast brass with stainless steel working parts. The diaphragm and disc shall be the elastomer type suited for water service. The device shall permit the attachment of portable hoses to hose thread outlets. Hose connection vacuum breakers shall be installed in the following locations requiring non-continuous pressure:

1. Hose bibbs and wall hydrants.

E. The pressure vacuum breaker shall be ASSE listed 1020. The main body shall be brass. The disc and O-ring seal shall be the elastomer type. The valve seat and disc float shall be the thermoplastic type. Tee handle or lever handle shut-off ball valves. Test cocks for testing and draining where freezing conditions occur. All materials shall be suitable for water service. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable. Pressure vacuum breakers shall be installed in the following locations requiring continuous pressure and no backpressure including equipment with submerged inlet connections:

1. 1. Lawn Irrigation.

F. The laboratory faucet vacuum breaker shall be ASSE listed 1035. The main body shall be cast brass. Dual check valves with stainless steel working parts. The diaphragm and disc shall be the elastomer type suited for water service. The device shall permit the attachment of portable hoses to laboratory faucets for non-continuous pressure applications.

G. The double check backflow prevention assembly shall be ASSE listed 1015 and supply with full port, OS&Y, positive-seal, resilient gate valves. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade. The seat ring and check valve shall be the thermoplastic type suited for water service. The stem shall be stainless steel conforming to ASTM A276/A276M. The seat disc shall be the elastomer type suited for water service. The first and second check valve shall be accessible for maintenance without removing the device from the line. Double check valves shall be installed in the following

location requiring continuous pressure subject to backpressure and backsiphonage conditions.

1. Lawn Irrigation.
2. Food Processing Equipment.
3. Laundry equipment.

H. 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.

I. 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. Install chain wheels on operators for ball, butterfly, gate and globe valves NPS 100 mm or DN100 (4 inches) and greater and installed greater than 3.0 m (10 feet) above floor. Chains shall be extended to 1524 mm (60 inches) above finished floor.

F. Check valves shall be installed for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level and on top of valve.

G. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that shall be sources of contamination. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment or system.

1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are prohibited for this application.

H. Install pressure gauges on outlet of backflow preventers.

I. Do not install bypass piping around backflow preventers.

J. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets.
   1. Install thermometers if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

K. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

L. Install thermostatic balancing valves with inlet strainer and inlet and outlet isolation valves.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Calibrated balancing valves.
   2. Master, thermostatic, water mixing valves.
   3. Manifold, thermostatic, water-mixing-valve assemblies.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.4 ADJUSTING

A. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Valves shall be replaced if persistent leaking occurs.

B. Set field-adjustable flow set points of balancing valves and record data. Ensure recorded data represents actual measured or observed conditions. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

D. Testing and adjusting of balancing valves shall be performed by an independent NEBB Accredited Test and Balance Contractor. A final settings and flow report shall be submitted to the VA COR.

3.5 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove

full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.6 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.7 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

- - - E N D - - -

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.
   2. Re-insulation of plumbing piping and equipment after asbestos abatement and or replacement of any part of existing insulation system (insulation, vapor retarder jacket, protective coverings/jacket) damaged during construction.

B. Definitions:
   1. ASJ: All Service Jacket, Kraft paper, white finish facing or jacket.
   2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
   3. All insulation systems installed within supply, return, exhaust, relief and ventilation air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, interiors of air conditioned or heating ducts, and mechanical equipment rooms shall be noncombustible or shall be listed and labeled as having a flame spread indexes of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723. Note: ICC IMC, Section 602.2.1.
   4. Cold: Equipment or piping handling media at design temperature of 15 degrees C (60 degrees F) or below.
   5. Concealed: Piping above ceilings and in chases, interstitial space, and pipe spaces.
   6. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
   7. FSK: Foil-scrim-Kraft facing.
   8. Hot: Plumbing equipment or piping handling media above 40 degrees C (104 degrees F).
   9. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).

10. Thermal conductance: Heat flow rate through materials.
    a. Flat surface: Watts per square meter (BTU per hour per square foot).
    b. Pipe or Cylinder: Watts per linear meter (BTU per hour per linear foot) for a given outside diameter.
11. Thermal Conductivity (k): Watts per meter, per degree K (BTU - inch thickness, per hour, per square foot, per degree F temperature difference).
12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders/vapor barriers shall have a maximum published permeance of .02 perms.
13. HWR: Hot water recirculating.
14. CW: Cold water.
15. SW: Soft water.
16. HW: Hot water.
17. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.
D. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT: Insulation containing asbestos material.
E. Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT: Insulation containing asbestos material.
F. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
G. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.
H. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING: Hot and cold water piping.
I. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.
J. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

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

B209-2014.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C411-2011.....Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449-2007 (R2013).....Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

C450-2008 (R2014).....Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging

Adjunct to C450.....Compilation of Tables that Provide Recommended Dimensions for Prefab and Field Thermal Insulating Covers, etc.

C533-2013.....Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534/C534M-2014.....Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547-2015.....Standard Specification for Mineral Fiber Pipe Insulation

C552-2014.....Standard Specification for Cellular Glass Thermal Insulation

C553-2013.....Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C591-2013.....Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

C680-2014.....Standard Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of

Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs

C612-2014.....Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126-2014.....Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-2012.....Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

C1710-2011.....Standard Guide for Installation of Flexible Closed Cell Preformed Insulation in Tube and Sheet Form

D1668/D1668M-1997a (2014)e1 Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-2015a.....Standard Test Method for Surface Burning Characteristics of Building Materials

E2231-2015.....Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation to Assess Surface Burning Characteristics

C. Federal Specifications (Fed. Spec.):

L-P-535E-1979.....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

D. International Code Council, (ICC):

IMC-2012.....International Mechanical Code

E. Military Specifications (Mil. Spec.):

MIL-A-3316C (2)-1990....Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (2)-1987...Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-PRF-19565C (1)-1988.Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier

MIL-C-20079H-1987.....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

F. National Fire Protection Association (NFPA):

90A-2015.....Standard for the Installation of Air-Conditioning and Ventilating Systems

G. Underwriters Laboratories, Inc (UL):

723-2008 (R2013).....Standard for Test for Surface Burning Characteristics of Building Materials

1887-2004 (R2013).....Standard for Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics

H. 3E Plus® version 4.1 Insulation Thickness Computer Program: Available from NAIMA with free download; https://insulationinstitute.org/tools-resources/

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 07 11, PLUMBING INSULATION", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

D. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM Designation, Federal and Military specifications.
   a. Insulation materials: Specify each type used and state surface burning characteristics.
   b. Insulation facings and jackets: Each type used and state surface burning characteristics.
   c. Insulation accessory materials: Each type used.
   d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation shall follow the guidelines in accordance with ASTM C1710.
   e. Make reference to applicable specification paragraph numbers for coordination.
   f. All insulation fittings (exception flexible unicellular insulation) shall be fabricated in accordance with ASTM C450 and the referenced Adjunct to ASTM C450.

E. Samples:
   1. Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/ blanket; 150 mm (6 inches) long, full diameter for round types.
   2. Each type of facing and jacket: Minimum size 100 mm (4 inches square).
   3. Each accessory material: Minimum 120 ml (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives / cement / mastic.

F. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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 owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version specified by the station provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

1.7 STORAGE AND HANDLING OF MATERIAL

A. Store materials in clean and dry environment, pipe insulation jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m^3 (nominal 3 pcf), k = 0.037 (.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).

B. ASTM C553 (Blanket, Flexible) Type I, 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 MINERAL WOOL OR REFRACTORY FIBER

A. Comply with Standard ASTM C612, Class 3, 450 degrees C (842 degrees F).

2.3 RIGID CELLULAR PHENOLIC FOAM

A. Preformed (molded) pipe insulation, ASTM C1126, Type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with vapor retarder and all service vapor retarder jacket (ASJ) and with PVC premolded fitting covering.

B. Equipment Insulation, ASTM C1126, Type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket (ASJ).

2.4 CELLULAR GLASS CLOSED-CELL

A. Comply with Standard ASTM C552, density 120 kg/m^3 (7.5 pcf) nominal, k = 0.033 (0.29) at 24 degrees C (75 degrees F).

B. Pipe insulation for use at process temperatures below ambient air to 482 degrees C (900 degrees F) with or without all service vapor retarder jacket (ASJ).

C. Pipe insulation for use at process temperatures for pipe and tube below ambient air temperatures or where condensation control is necessary are to be installed with a vapor retarder/barrier system of with or without all service vapor retarder sealed jacket (ASJ) system. Without ASJ shall require all longitudinal and circumferential joints to be vapor sealed with vapor barrier mastic.

D. Cellular glass thermal insulation intended for use on surfaces operating at temperatures between –268 and 482 degrees C (–450 and 900 degrees F). It is possible that special fabrication or techniques for pipe insulation, or both, shall be required for application in the temperature range from 121 to 427 degrees C (250 to 800 degrees F).

2.5 POLYISOCYANURATE CLOSED-CELL RIGID

A. Preformed (fabricated) pipe insulation, ASTM C591, Type IV, K=0.027(0.19) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for use at temperatures up to 149 degree C (300 degree F) with factory applied PVDC or all service vapor retarder jacket with PVC premolded fitting covers.

B. Equipment and duct insulation, ASTM C591, Type IV, K=0.027(0.19) at 24 degrees C (75 degrees F), for use at temperatures up to 149 degrees C (300 degrees F) with PVDC or all service jacket vapor retarder jacket.

2.6 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

A. ASTM C534/C534M, k = 0.039 (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (199 degrees F). Under high humidity exposures for condensation control an external vapor retarder/barrier jacket is required. Consult ASTM C1710.

2.7 CALCIUM SILICATE

A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.

B. Premolded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.

C. Equipment Insulation: ASTM C533, Type I and Type II.

D. Characteristics:

Insulation Characteristics		
ITEMS	**TYPE I**	**TYPE II**
Surface Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m^3 (lb/ ft3)	240 (15)	352 (22)
Thermal conductivity: Min W/ m K (Btu in/h ft^2 degrees F)@ mean temperature of 93 degrees C (199 degrees F)	0.065 (0.45)	0.078 (0.540)
Surface burning characteristics: Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

2.8 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be ASJ or PVDC Vapor Retarder jacketing.

B. ASJ shall be white finish (kraft paper) bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive

adhesive closure. Comply with ASTM C1136. Beach puncture is 50 units, suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: FSK or PVDC type for concealed ductwork and equipment.

D. Except for flexible elastomeric cellular thermal insulation (not for high humidity exposures), field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

E. Except for cellular glass thermal insulation, when all longitudinal and circumferential joints are vapor sealed with a vapor barrier mastic or caulking, vapor barrier jackets may not be provided. For aesthetic and physical abuse applications, exterior jacketing is recommended. Otherwise field applied vapor barrier jackets shall be provided, in addition to the applicable specified facings and jackets, on all exterior piping as well as on interior piping. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

F. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2070 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.

G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be PVC conforming to Fed Spec L-P-535E, composition A, Type II Grade GU, and Type III, minimum

thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape. Staples, tacks, or any other attachment that penetrates the PVC covering is not allowed on any form of a vapor barrier system in below ambient process temperature applications.

H. Aluminum Jacket-Piping systems and circular breeching and stacks: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated or with cut aluminum gores to match shape of fitting and of 0.6 mm (0.024 inch) minimum thickness aluminum. Aluminum fittings shall be of same construction with an internal moisture barrier as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands with wing seals shall be installed on all circumferential joints. Bands shall be 15 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

I. Aluminum jacket-Rectangular breeching: ASTM B209, 3003 alloy, H-14 temper, 0.5 mm (0.020 inches) thick with 32 mm (1-1/4 inch) corrugations or 0.8 mm (0.032 inches) thick with no corrugations. System shall be weatherproof if used for outside service.

2.9 PIPE COVERING PROTECTION SADDLES

A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m^3 (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	**Insert Blocks mm (inches)**
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high

density Polyisocyanurate (for temperatures up to 149 degrees C (300 degrees F)), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m^3 (3.0 pcf).

2.10 ADHESIVE, MASTIC, CEMENT

A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.

B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.

C. Mil. Spec. MIL-A-24179A, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.

D. Mil. Spec. MIL-PRF-19565C, Type I: Protective finish for outdoor use.

E. Mil. Spec. MIL-PRFC-19565C, Type I or Type II: Vapor barrier compound for indoor use.

F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.

G. Other: Insulation manufacturers' published recommendations.

2.11 MECHANICAL FASTENERS

A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.

B. Staples: Outward clinching galvanized steel. Staples are not allowed for below ambient vapor barrier applications.

C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy or stainless steel.

D. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

E. Tacks, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall NOT be used to attach/close the any type of vapor retarder jacketing. Thumb tacks sometimes used on PVC jacketing and preformed fitting covers closures are not allowed for below ambient vapor barrier applications.

2.12 REINFORCEMENT AND FINISHES

A. Glass fabric, open weave: ASTM D1668/D1668M, Type III (resin treated) and Type I (asphalt or white resin treated).

B. Glass fiber fitting tape: Mil. Spec MIL-C-20079H, Type II, Class 1.

C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.

D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.

E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.

F. PVC fitting cover: Fed. Spec L-P-535E, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 10 to 121 degrees C (50 to 250 degrees F). Below 10 degrees C (50 degrees F) and above 121 degrees C (250 degrees F) provide mitered pipe insulation of the same type as insulating straight pipe. Provide double layer insert. Provide vapor barrier pressure sensitive tape matching the color of the PVC jacket.

2.13 FIRESTOPPING MATERIAL

A. Other than pipe insulation, refer to Section 07 84 00, FIRESTOPPING.

2.14 FLAME AND SMOKE

A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM and UL standards and specifications. See paragraph "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Required pressure tests of piping joints and connections shall be completed and the work approved by the COR for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions or as noted, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.

C. Where removal of insulation of piping and equipment is required to comply with Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT and Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT, such areas shall be reinsulated to comply with this specification.

D. Insulation materials shall be installed with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down and

sealed at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A).

E. Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 15 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

F. Install vapor stops with operating temperature 15 degrees C (60 degrees F) and below at all insulation terminations on either side of valves, pumps, fittings, and equipment and particularly in straight lengths every 4.6 to 6.1 meters (approx. 15 to 20 feet) of pipe insulation. The annular space between the pipe and pipe insulation of approx. 25 mm (1 inch) in length at every vapor stop shall be sealed with appropriate vapor barrier sealant. Bio-based materials shall be utilized when possible.

G. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment. Do not insulate over equipment nameplate data.

H. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer coating (caution about coating’s maximum temperature limit) or jacket material.

I. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

J. Plumbing work not to be insulated unless otherwise noted:
   1. Piping and valves of fire protection system.
   2. Chromium plated brass piping.
   3. Water piping in contact with earth.
   4. Distilled water piping.

K. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum wet or dry film thickness. Bio-based materials shall be utilized when possible.

L. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. Use of polyurethane or polyisocyanurate spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

M. Firestop Pipe insulation:

1. Provide firestopping insulation at fire and smoke barriers through penetrations. Firestopping insulation shall be UL listed as defined in Section 07 84 00, FIRESTOPPING.
2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
   a. Pipe risers through floors
   b. Pipe chase walls and floors
   c. Smoke partitions
   d. Fire partitions
   e. Hourly rated walls

N. Provide vapor barrier systems as follows:

1. All piping exposed to outdoor weather.
2. All interior piping conveying.

O. Provide metal jackets over insulation as follows:

1. All plumbing piping exposed to outdoor weather.
2. Piping exposed in building, within 1829 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets except for cold pipe or tubing applications. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
3. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

P. Provide PVC jackets over insulation as follows:

1. Piping exposed in building, within 1829 mm (6 feet) of the floor, on piping that is not precluded in previous sections.
2. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:

1. Vapor retarder faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. (Bio-based materials shall be utilized when possible.) Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
2. Plain unfaced board:
   a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
   b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowelled to a smooth finish.
   c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
3. Cold equipment: 40 mm (1-1/2inch) thick insulation faced with vapor retarder ASJ or FSK. Seal all facings, laps, and termination points and do not use staples or other attachments that may puncture ASJ or FSK.
   a. Water filter, chemical feeder pot or tank.
   b. Pneumatic, cold storage water and surge tanks.
4. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with unsealed ASJ or FSK.
   a. Domestic water heaters and hot water storage tanks (not factory insulated).
   b. Booster water heaters for dietetics dish and pot washers and for washdown grease-extracting hoods.

B. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe, aligning all longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation except for cold piping. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide cellar glass inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
   a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 15 degrees C (60 degrees F) or more.
   b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts surface temperature of above 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Provide mitered preformed insulation of the same type as the installed straight pipe insulation for pipe temperatures below 4 degrees C (40 degrees F). Secure first layer of mineral fiber insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
   c. Factory preformed, ASTM C547 or fabricated mitered sections, joined with adhesive or (hot only) wired in place. (Bio-based materials shall be utilized when possible.) For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 15 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
   d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

C. Rigid Cellular Phenolic Foam:

1. Rigid closed cell phenolic insulation may be provided, exterior only, for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).

2. Note the ASTM E84 or UL 723 surface burning characteristics requirements of maximum 25/50 indexes in paragraph "Quality Assurance".
3. Provide secure attachment facilities such as welding pins.
4. Apply insulation with joints tightly drawn together.
5. Apply adhesives, coverings, neatly finished at fittings, and valves.
6. Final installation shall be smooth, tight, neatly finished at all edges.
7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.
8. Condensation control insulation: Minimum 25 mm (1 inch) thick for all pipe sizes depending on high humidity exposures.
   a. Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.
   b. Waste piping from electric water coolers and icemakers to drainage system.
   c. Waste piping located above basement floor from ice making and film developing equipment and air handling units, from equipment (including trap) to main vertical waste pipe.
   d. MRI quench vent piping.
   e. Bedpan sanitizer atmospheric vent
   f. Reagent grade water piping.
   g. Cold water piping, exterior only.

D. Cellular Glass Insulation:
1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.
2. Underground piping other than or in lieu of that specified in Section 22 11 00, FACILITY WATER DISTRIBUTION: Type II, factory jacketed with a 3 mm laminate jacketing consisting of 3000 mm x 3000 mm (10 ft x 10 ft) asphalt impreganted glass fabric, bituminous mastic and outside protective plastic film.
   a. 75 mm (3 inches) thick for hot water piping.
   b. As scheduled at the end of this section for chilled water piping.
   c. Underground piping: Apply insulation with joints tightly butted. Seal longitudinal self-sealing lap. Use field fabricated or factory made fittings. Seal butt joints and fitting with

jacketing as recommended by the insulation manufacturer. Use 100 mm (4 inch) wide strips to seal butt joints.

d. Provide expansion chambers for pipe loops, anchors and wall penetrations as recommended by the insulation manufacturer.

e. Underground insulation shall be inspected and approved by the COR as follows:

1) Insulation in place before coating.

2) After coating.

f. Sand bed and backfill: Minimum 75 mm (3 inches) all around insulated pipe or tank, applied after coating has dried.

g. All piping up to 482 degrees C (900 degrees F) requiring protection from physical heavy contact/abuse including in mechanical rooms and exposures to the public.

3. Cold equipment: 50 mm (2 inch) thick insulation faced with ASJ.

E. Polyisocyanurate Closed-Cell Rigid Insulation:

1. Polyisocyanurate closed-cell rigid insulation (PIR) may be provided for exterior piping and equipment for temperature up to 149 degree C (300 degree F).
2. Install insulation, vapor retarder and jacketing per manufacturer’s recommendations. Particular attention should be paid to recommendations for joint staggering, adhesive application, external hanger design, expansion/contraction joint design and spacing and vapor retarder integrity.
3. Install insulation with all joints tightly butted (except expansion) joints in hot applications). Provide insulation contractions joints for very cold process temperatures.
4. If insulation thickness exceeds 65 mm (2-1/2 inches), install as a double layer system with longitudinal (lap) and butt joint staggering as recommended by manufacturer.
5. For cold applications, vapor retarder shall be installed in a continuous manner. No staples, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall be used to attach the vapor retarder or jacketing. No wire ties capable of penetrating the vapor retarder shall be used to hold the insulation in place. Stainless steel banding shall be used for cold applications to attach PVC or metal jacketing.

6. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane or polyisocyanurate spray-foam to fill PVC elbow jacket is prohibited on cold applications.
7. For cold applications, the vapor retarder on elbows/fittings shall be either mastic-fabric-mastic or 2 mil thick PVDC vapor retarder adhesive tape. Bio-based materials shall be utilized when possible.
8. All PVC and metal jacketing shall be installed so as to naturally shed water. Joints shall point down and shall be sealed with either adhesive or caulking (except for periodic slip joints). Bio-based materials shall be utilized when possible.
9. Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph "Quality Assurance". Refer to paragraph “General Requirements” for items not to be insulated.
10. Minimum thickness in millimeter (inches) specified in the schedule at the end of this section.

F. Flexible Elastomeric Cellular Thermal Insulation:
1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer. External vapor barrier jacketing may be required for expected or anticipated high humidity exposures. See ASTM C1710.
2. Pipe and tubing insulation:
   a. Use proper size material. Do not stretch or strain insulation.
   b. To avoid undue compression of insulation, use supports as recommended by the elastomeric insulation manufacturer. Insulation shields are specified under Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
   c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Bio-based materials shall be utilized when possible.

3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.

G. Calcium Silicate:

1. Minimum thickness in millimeter (inches) specified below for piping other than in boiler plant.

Nominal Thickness Of Calcium Silicate Insulation (Non-Boiler Plant)				
Nominal Pipe Size Millimeters (Inches)	Thru 25 (1)	32 to 75 (1-1/4 to 3)	100-200 (4 to 8)	Greater than 200 (8)
93-260 degrees C (199-500 degrees F)(HPS, HPR)	100(4)	125(5)	150(6)	Greater than 150(6)

2. MRI Quench Vent Insulation: Type I, class D, 150 mm (6 inch) nominal thickness.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 PIPE INSULATION SCHEDULE

A. Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	**Insulation Material**	**Less than 25 (1)**	**25 – 32 (1 – 1¼)**	**38 – 75 (1½ - 3)**	**100 (4) and Greater**
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)

(Domestic Hot Water Supply and Return)	(Above ground piping only) (exterior locations only)				
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Polyiso-cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Cellular Glass Thermal	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
4-15 degrees C (40-60 degrees F)	Rigid Cellular Phenolic Foam (Above ground piping only) (exterior locations only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
4-15 degrees C (40-60 degrees F)	Polyiso-cyanurate Closed-Cell Rigid(Exterior Locations only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
(4-15 degrees C (40-60 degrees F)	Flexible Elastomeric	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)

	Cellular Thermal (Above ground piping only)				
4-15 degrees C (40-60 degrees F)	Cellular Glass Thermal	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)

- - - E N D - - -

SECTION 22 08 00
COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL
1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 22.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the Department of Veterans Affairs will manage the commissioning process.

1.2 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

A. This Section includes requirements for commissioning plumbing systems, subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.

B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more specifics regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 22 is part of the construction process. Documentation and testing of these systems, as well as training of the VA’s Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 22, is required in cooperation with the VA and the Commissioning Agent.

B. The Plumbing systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:

1.6 SUBMITTALS

A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

A. Commissioning of the Building Plumbing Systems will require inspection of individual elements of the Plumbing construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning Plan to schedule inspections as required to support the commissioning process.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and

resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 22 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the COR. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.5 TRAINING OF VA PERSONNEL

A. Training of the VA operation and maintenance personnel is required in cooperation with the COR and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00. The instruction shall be scheduled in coordination with the COR after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING

REQUIREMENTS and Division 22 Sections for additional Contractor training requirements.

- - - E N D - - -

SECTION 22 08 16
DISINFECTION OF POTABLE WATER PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the Disinfection requirements for the following:
New, repaired or modified systems

1. Potable water distribution piping (on Project site and within buildings)

B. Dechlorination procedures for chlorinated water discharge.

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 22 11 00, FACILITY WATER DISTRIBUTION.

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 Water Works Association (AWWA):
C651-2005.....Standard for Disinfecting Water Mains

C. International Code Council (ICC):
IPC-2012.....International Plumbing Code

D. NSF International (NSF):
61-2012.....Drinking Water System Components – Health Effects
372-2011.....Drinking Water System Components – Lead Content

1.4 DESCRIPTION

A. Water quality testing: Contractor shall arrange for water quality testing of water samples taken from piping systems for chlorine concentrations and bacteriological quality. COR will approve use of disinfected piping when test results demonstrate compliance with water quality requirements of the Safe Drinking Water Act as described in Section 1.4.D. Contractor shall furnish disinfection report to COR.

B. Disinfection Requirements
   1. Protect interiors of pipes, fittings, and valves against contamination during construction.
      a. All pipe shall be temporarily capped or plugged prior to transporting to construction site to prevent any foreign material from entering pipe.
      b. Close openings of piping when pipe-laying or placement is stopped at end of workday or for other reasons, such as rest breaks or meal periods.
   2. Do not disinfect any pipe until source of potable water supply used for flushing or disinfection is approved by COR.
   3. Contractor shall arrange for water quality testing of water samples taken from piping systems for chlorine concentrations and bacteriological quality as described in Section 1.4.D.
   4. Do not place piping in service until notified by COR that water quality test results are approved by COR, as described in Section 1.4.D.
   5. Re-flush and retest disinfected potable water piping that has been allowed to stand stagnant for more than 30 days before being placed in service.
   6. Disinfect piping within building with service taps and fixtures installed. Flow chlorinated water and flush water through lavatories, sinks, drinking fountains, showers, and hose bibbs.

C. Water Discharge Requirements
   1. Neutralize chlorinated water used for disinfection prior to discharge as described in “Dechlorination of Discharges (Neutralization)” Section 3.4.
   2. To discharge chlorinated/dechlorinated water, notify COR and arrange for a total chlorine concentration test as described in Section 1.4.D.
   3. Obtain approval from COR prior to ANY discharges.

D. Water Quality Testing Requirements
   1. Arrange for a bacterial quality or free or total chlorine concentration test and notify COR at least 48 hours (2 working days) in advance.

2. Requirements for demonstration of compliance with the Maximum Containment Level (MCLs) of the Safe Drinking Water Act:
   a. Total chlorine concentration of less than 1 mg/L (1 ppm).
   b. The absence of any coliform bacteria.
   c. Less than 200 non-coliform bacteria per 100 mL sample.

PART 2 – PRODUCTS

2.1 MATERIAL SAFETY DATA SHEETS

A. Maintain on-site Material Safety Data Sheets (MSDS) for chemical products, including disinfection and dechlorination products.

2.2 ACCEPTABLE DISINFECTANTS

A. Sodium hypochlorite solution (bleach) contains approximately 5 – 6 percent available chlorine, or 50,000 to 60,000 ppm. Thus, a 1:1000 dilution of bleach in water results in a chlorine concentration of about 50 ppm. Use care in control of conditions and length of storage to minimize its deterioration.

B. Calcium hypochlorite [$Ca(OCl)_2$] granules and tablets per AWWA B300. This contains approximately 65 percent available chlorine by weight. It will not readily dissolve in water with a temperature of less than 41 deg F. Store in a cool, dry, and dark environment to minimize its deterioration. Direct placement of solid phase into piping is not permitted. Do not use calcium hypochlorite intended for swimming pools (e.g., HTH), as this material has been sequestered and is extremely difficult to eliminate from the pipe.

C. Disinfection with pure chlorine gas or liquid is not permitted.

2.3 ACCEPTABLE DECHLORINATION (NEUTRALIZING) AGENTS

A. Use Vitamin C salt (sodium ascorbate, Vita-D-Chlor brand or equal) for discharges to a live stream [as it doesn’t increase the alkalinity and it reduces the dissolved oxygen less than sodium thiosulfate]. Sodium thiosulfate (technical grade, prismatic rice) is acceptable for discharges elsewhere.

B. Sulfur dioxide gas use is not permitted.

2.4 PRECAUTIONS

A. Calcium hypochlorite is corrosive and is a strong oxidizer. Reducing agents (e.g., sodium ascorbate or thiosulfate), concentrated acids, and organic compounds (e.g. antifreeze, gasoline), can oxidize, burn or explode if they come into contact with solid-phase calcium hypochlorite.

B. Do not use calcium hypochlorite on solvent-welded plastic pipe or on screwed-joint steel pipe because of danger of fire or explosion from reaction with joint compounds (exception: PFTE “Teflon” tape).

C. Disinfecting solutions containing chlorine shall not exceed 12% active chlorine; greater concentrations can chemically attack and degrade polyethylene.

PART 3 - EXECUTION

3.1 DISINFECTION OF NEW WATER MAINS

A. Preliminary flushing

1. Prior to disinfection, fill main with water to eliminate air pockets.
2. Flush new mains thoroughly before connection is made to system piping in order to remove foreign materials that might have entered the main during the course of the installation or that might have been present in existing piping. The VA COR shall be notified in advance to witness the flushing of the system. After flushing ALL screens on ALL plumbing fixtures, mixing valves, strainers, etc. shall be cleaned.
3. The minimum rate of flow shall greater than the water demand rate of the system, which is determined by the system design. Where the main supplies a fire supply sprinkler system, flow shall provide an NFPA 24 velocity of 10 ft/s (3 m/s) even if the demand rate may be less. Flow/velocity table below.
4. Follow AWWA C651, "Disinfecting Water Mains," using Continuous Feed Method where practical.

   Exception: For mains supplying fire systems, when the flow rate as listed in table below cannot be verified or met, supply piping shall be flushed at the maximum flow rate available to the system under fire conditions.

Flow Required to Produce a Velocity of 10 Ft per Second (3 m/s) in Pipes (NFPA 24)

Nominal Pipe Size (in.)	Flow Rate (gpm)	Flow Rate (L/min)
4	390	1476
6	880	3331
8	1560	5905

10	2440	9235
12	3520	13323

5. For all systems, the flushing operation shall be continued for a sufficient time to ensure thorough cleaning. This shall entail more than one flushing and to be verified by VA COR.
6. Obtain verification from COR that system has been thoroughly cleaned (flushed) and is ready for chlorination.

B. Chlorination of the Main

1. Inject chlorinated water, with a free chlorine concentration of not less than 25 mg/L, into main at a point no more than 10 feet downstream from beginning of new main. Verify free chlorine concentration of not less than 25 mg/L by an initial free chlorine concentration test as described in Section 1.4.D.
2. Leave chlorinated water in main for at least 24 hours during which time valves and hydrants in system shall be operated to ensure disinfection of the appurtenances.
3. At end of 24-hour period, treated water in all portions of main shall have a free chlorine concentration of not less than 10 mg/L. Verify this by a residual free chlorine concentration test as described in Section 1.4.D.
4. After residual free chlorine concentration test has been completed, flush system with potable water until total chlorine concentration in main is less than 1 mg/L (1 ppm). The test shall be verified by VA COR.
5. After final flushing, arrange for final total chlorine concentration and bacteriological quality tests as described in Section 1.4.D.
6. After final total chlorine concentration and bacteriological quality tests have been completed, Contractor shall furnish disinfection report to COR. If water quality tests do not show compliance with water quality requirements of the Safe Drinking Water Act as described in Section 1.4.D, repeat 1, 2, 3, and 4 until test results demonstrate compliance.

3.2 DISINFECTION OF NEW INTERIOR POTABLE WATER SYSTEM

A. Flush until discolored water is eliminated and water flows clear.

B. Chlorination of piping

1. Use chlorinated water, with free chlorine concentration of not less than 25 mg/L. Verify this by an initial free chlorine concentration test as described in Section 1.4.D.
2. Retain chlorinated water in piping for at least 24 hours, during which time lavatories, sinks, drinking fountains, showers, and hose bibs shall be operated to ensure disinfection of appurtenances.
3. At end of 24-hour period, treated water in all portions of piping shall have a free chlorine concentration of not less than 10 mg/L. Contractor shall verify this minimum concentration by a residual free chlorine concentration test as described in Section 1.4.D.
4. After residual free chlorine concentration test has been completed, flush system with potable water until total chlorine concentration in piping is less than 1 mg/L (1 ppm), discharging as follows:
   a. If total quantity of chlorinated waters is less than 20 gallons, it may be discharged directly to sanitary wastewater collection system without regard to chlorine concentration.
   b. If total quantity of chlorinated water for disinfection is over 20 gallons, then:
      1) Neutralize and test disinfection water prior to discharge as described in Section 1.3 and "Dechlorination of Discharges (Neutralization)" Section 3.4 below, and
      2) Discharge to environment or sanitary sewer.

3.3 DISINFECTION DURING AND FOLLOWING REPAIR OR MINOR MODIFICATION OF EXISTING MAINS OR INTERIOR PIPING

A. Before Repair

1. Where practical, isolate a section of affected line and shut off all service connections.
2. Swab or spray the inside of new pipe and fittings with a minimum of 1 percent (10,000 ppm) hypochlorite solution before they are installed. Disinfect tools to be used in same manner.

B. Flushing after Repair

1. Prior to disinfection, flush affected line to clean out contamination introduced during repairs. If possible, flush from both directions. Flush until discolored water is eliminated, and water flows clear. If line segment cannot be isolated, thoroughly flush the segment to a tank or through a fire hydrant. Follow

requirements listed for notification and possible dechlorination requirements.

2. Obtain verification that COR has witnessed that the affected line has been thoroughly cleaned (flushed) and is ready for chlorination.

C. Apply chlorine to water to expose interior surfaces of affected segment at the chlorine concentration and contact times as follows; verify total chlorine concentration by an initial total chlorine concentration test as described in Section 1.4.D:

Chlorine Concentration (mg/L, ppm)	Contact Time
300	15 minutes
250	1 hour
200	1.5 hours
150	2 hours
100	3 hours

D. Retain chlorinated water in main, or piping, for above prescribed contact time. At the end of prescribed time period, flush affected line with potable water until total chlorine concentration in main is less than 1 mg/L (1 ppm).

E. After flushing, Contractor shall arrange for final total chlorine concentration and bacteriological quality tests as described in Section 1.4.D.

F. After final total chlorine concentration and bacteriological quality tests have been completed, Contractor shall furnish disinfection report to COR. If water quality tests do not show compliance with water quality requirements of the Safe Drinking Water Act as described in Section 1.4.D, repeat E, F, and G above until test results demonstrate compliance.

3.4 DECHLORINATION OF DISCHARGES (NEUTRALIZATION)

A. Provide mixing tank to allow dechlorination of water prior to discharge. Stir in neutralizer crystals allowed per Part 2 manually.

B. Approximate dosage rate of neutralizer may be calculated from the following table:

Free Chlorine Residual Concentration	Sodium Ascorbate (Vita-D-Chlor)	Sodium Thiosulfate
10 mg/L	2.2 lb/10,000 gal	1.2 lb/10,000 gal

50 mg/L	11 lb/10,000 gal	6 lb/10,000 gal
500 mg/L	110 lb/10,000 gal	60 lb/10,000 gal

C. Do not dose neutralizing chemical beyond the minimum required to neutralize the chlorine actually present in discharge.

- - - E N D - - -

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 91 00, GENERAL COMMISSIONING 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.

I. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):

A13.1-2007 (R2013).....Scheme for Identification of Piping Systems

B16.3-2011.....Malleable Iron Threaded Fittings: Classes 150 and 300

B16.9-2012.....Factory-Made Wrought Buttwelding Fittings

B16.11-2011.....Forged Fittings, Socket-Welding and Threaded

B16.12-2009 (R2014).....Cast Iron Threaded Drainage Fittings

B16.15-2013 .....Cast Copper Alloy Threaded Fittings: Classes 125 and 250

B16.18-2012.....Cast Copper Alloy Solder Joint Pressure Fittings

B16.22-2013.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.24-2011.....Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500

ASME Boiler and Pressure Vessel Code -

BPVC Section IX-2015....Welding, Brazing, and Fusing Qualifications

C. 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 DISTRIBUTIONS", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. All items listed in Part 2 - Products.

D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

E. Completed System Readiness Checklist provided by the CxA and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

F. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. A certificate shall be submitted prior to welding of steel piping showing the Welder’s certification. The certificate shall be current and no more than one year old. Welder’s qualifications shall be in accordance with ASME BPVC Section IX.

B. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.

C. All pipe, couplings, fittings, and specialties shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.

D. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 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 shall be included. A list of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version specified by the station 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. For pipe 150 mm (6 inches) and larger, stainless steel, ASTM A312, schedule 10 or 40 shall be used determined by station preference.

B. Fittings for Copper Tube:

1. Wrought copper or bronze castings conforming to ASME B16.18 and B16.22. Unions shall be bronze, MSS SP-72, MSS SP-110, solder or braze joints. Use 95/5 tin and antimony for all soldered joints.
2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75/B75M C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, C84400. Mechanical grooved couplings, 2070 kPa (300 psig) minimum ductile iron, ASTM A536 Grade 448-310-12 (Grade 65-45-12), or malleable iron, ASTM A47/A47M Grade 22410 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
3. Mechanical press-connect fittings for copper pipe and tube **are prohibited**. See Plumbing Design Manual for additional information.
4. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall ensure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.
5. Flanged fittings, bronze, class 150, solder-joint ends conforming to ASME B16.24.

C. Fittings for Stainless Steel:

1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ASME B16.9.
2. Grooved fittings, stainless steel, Type 316, Schedule 10 or 40 determined by station preference, conforming to ASTM A403/A403M. Segmentally fabricated fittings are not allowed. Mechanical grooved

couplings, ductile iron, 4138 kPa (600 psig), ASTM A536 Grade 448-310-12 (Grade 65-45-12), or malleable iron, ASTM A47/A47M Grade 22410 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

D. Adapters: Provide adapters for joining pipe or tubing with dissimilar end connections.

E. Solder: ASTM B32 alloy type Sb5, HA or HB. Provide non-corrosive flux.

F. Brazing alloy: AWS A5.8M/A5.8, brazing filler metals shall be BCuP series for copper to copper joints and BAg series for copper to steel joints.

G. Re-agent Grade Water Piping and Dialysis Water Piping:

1. Polypropylene, ASTM F2389, Schedule 80 pressure pipe without additions of modifiers, plasticizers, colorants, stabilizers or lubricants. Bio-based materials shall be utilized when possible. This virgin un-plasticized pipe and fittings shall transport 10 megohm water with no loss of purity. Provide socket or butt end fittings with ASTM D2657 heat fusion joints.
2. Polyethylene, ASTM F2769, Schedule 80, food and medical grade, capable of transporting 10 megohm water with no loss of purity. Processed by continuous compression molding without the addition of fillers, polymer modifiers or processing aids. Uniform color with no cracks, flaws, blisters or other imperfections in appearance. Provide ASTM D2657 or ASTM F2620 heat fusion butt welded joints. In accordance with manufacturer's recommendations, provide continuous channel support under all horizontal piping.
3. Reverse Osmosis (RO) Water Piping:
   a. Low Pressure Feed, Reject and Recycle Piping: Less than or equal to 520 kPa (75 psig): ASTM D1785, Schedule 80 PVC, ASTM D2855 socket welded and flanged.
   b. RO Product Tubing from each Membrane Housing: ASTM D1785, Schedule 80 PVC, ASTM D2855 socket welded and flanged.
   c. Low Pressure Control and Pressure Gage Tubing: Polyethylene.
   d. High Pressure Reject and Recycle Piping: Greater than 520 kPa (75 psig): ASTM A269/A269M, Type 304 schedule 10 stainless steel with butt welded joints.
   e. High Pressure Control and Pressure Gage Tubing: 6895 kPa (1000 psig) burst nylon.

2.3 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 ETHYLENE OXIDE (ETO) STERILIZER WATER SUPPLY PIPING

A. Stainless steel, ASTM A312, Schedule 10 with stainless-steel butt-welded fittings. Provide on sterilizer water supply.

2.5 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.

2.6 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.

2.7 DIELECTRIC FITTINGS

A. Provide dielectric couplings or unions between pipe of dissimilar metals.

2.8 STERILIZATION CHEMICALS

A. Hypochlorite: ASTM E1229.

B. Liquid Chlorine: ASTM E1120.

2.9 WATER HAMMER ARRESTER

A. Closed copper tube chamber with permanently sealed 413 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N 0-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010. Access shall be provided where devices are concealed within partitions or above ceilings. Size and install in accordance with PDI-WH 201 requirements. Provide water hammer arrestors at:

1. All solenoid valves.
2. All groups of two or more flush valves.
3. All quick opening or closing valves.
4. All medical washing equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with the International Plumbing Code and the following:

1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to remove burrs and a clean smooth finish restored to full pipe inside diameter.
3. All pipe runs shall be laid out to avoid interference with other work/trades.
4. Install union and shut-off valve on pressure piping at connections to equipment.
5. Pipe Hangers, Supports and Accessories:
   a. All piping shall be supported per the IPC, H-18-8 Seismic Design Handbook, MSS SP-58, and SMACNA as required.
   b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
   c. Floor, Wall and Ceiling Plates, Supports, Hangers:
      1) Solid or split un-plated cast iron.
      2) All plates shall be provided with set screws.
      3) Pipe Hangers: Height adjustable clevis type.

4) Adjustable Floor Rests and Base Flanges: Steel.
5) Concrete Inserts: "Universal" or continuous slotted type.
6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
7) Pipe Hangers and Riser Clamps: Malleable iron or carbon steel. Pipe Hangers and riser clamps shall have a copper finish when supporting bare copper pipe or tubing.
8) Rollers: Cast iron.
9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
10) Hangers and supports utilized with insulated pipe and tubing shall have 180-degree (minimum) metal protection shield centered on and welded to the hanger and support. The shield thickness and length shall be engineered and sized for distribution of loads to preclude crushing of insulation without breaking the vapor barrier. The shield shall be sized for the insulation and have flared edges to protect vapor-retardant jacket facing. To prevent the shield from sliding out of the clevis hanger during pipe movement, center-ribbed shields shall be used.
11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
12) With the installation of each flexible expansion joint, provide piping restraints for the upstream and downstream section of the piping at the flexible expansion joint. Provide calculations supporting the restraint length design and type of selected restraints. Restraint calculations shall be based on the criteria from the manufacturer regarding their restraint design.

6. Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

7. Penetrations:
   a. Firestopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke, and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the firestopping materials.
   b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.
   c. Acoustical sealant: Where pipes pass through sound rated walls, seal around the pipe penetration with an acoustical sealant that is compliant with ASTM C919.

B. Domestic Water piping shall conform to the following:
   1. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot and cold water circulating lines with no traps.
   2. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

3.2 TESTS

A. General: Test system either in its entirety or in sections. Submit testing plan to COR 10 working days prior to test date.

B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 1035 kPa (150 psig) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested. Pressure gauge shall have 1 psig increments.

C. Re-agent Grade Water Systems: Fill system with water and maintain hydrostatic pressure of 1380 kPa (200 psig) gage during inspection and prove tight.

D. All Other Piping Tests: Test new installed piping under 1-1/2 times actual operating conditions and prove tight.

E. The test pressure shall hold for the minimum time duration required by the applicable plumbing code or authority having jurisdiction.

3.3 STERILIZATION

A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.

B. Use liquid chlorine or hypochlorite for sterilization.

3.4 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for four hours to instruct VA Personnel in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

- - - E N D - - -

SECTION 22 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 91 00, GENERAL COMMISSIONING 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.

I. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS

J. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

K. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):

A13.1-2007.....Identification of Piping Systems
A112.36.2M-1991.....Cleanouts
A112.6.3-2019.....Floor and Trench Drains
B1.20.1-2013.....Pipe Threads, General Purpose (Inch)
B16.1-2015.....Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
B16.4-2016.....Grey Iron Threaded Fittings Classes 125 and 250
B16.15-2018.....Cast Copper Alloy Threaded Fittings, Classes 125 and 250
B16.18-2018.....Cast Copper Alloy Solder Joint Pressure Fittings
B16.21-2016.....Nonmetallic Flat Gaskets for Pipe Flanges
B16.22-2018.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
B16.23-2016.....Cast Copper Alloy Solder Joint Drainage Fittings: DWV
B16.24-2016.....Cast Copper Alloy Pipe Flanges and Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500
B16.29-2017.....Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings: DWV
B16.39-2014.....Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
B18.2.1-2012.....Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

C. American Society of Sanitary Engineers (ASSE):

1001-2017.....Performance Requirements for Atmospheric Type Vacuum Breakers
1018-2001.....Performance Requirements for Trap Seal Primer Valves – Potable Water Supplied

1044-2015.....Performance Requirements for Trap Seal Primer Devices – Drainage Types and Electronic Design Types

1079-2012.....Performance Requirements for Dielectric Pipe Unions

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

A53/A53M-2018.....Standard Specification for Pipe, Steel, Black And Hot-Dipped, Zinc-coated, Welded and Seamless

A74-2017.....Standard Specification for Cast Iron Soil Pipe and Fittings

A888-2018a.....Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

B32-2008(R2014).....Standard Specification for Solder Metal

B43-2015.....Standard Specification for Seamless Red Brass Pipe, Standard Sizes

B88-2016.....Standard Specification for Seamless Copper Water Tube

B306-2013.....Standard Specification for Copper Drainage Tube (DWV)

B687-1999(R2016).....Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples

B813-2016.....Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube

B828-2016.....Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

C564-2014.....Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

D2321-2018.....Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2564-2012(R3018).....Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

D2665-2014.....Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D2855-2015.....Standard Practice for Two-Step (Primer and Solvent Cement) Method of Joining Poly(Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) CPVCP Pipe and Piping Components with Tapered Sockets

D5926-2015.....Standard Specification for Poly(Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

F402-2018.....Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

F477-2014.....Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F1545-2015e1.....Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges

E. Cast Iron Soil Pipe Institute (CISPI):

2006.....Cast Iron Soil Pipe and Fittings Handbook

301-2012.....Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

310-2012.....Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

F. Copper Development Association, Inc. (CDA):

A4015-14/19.....Copper Tube Handbook

G. International Code Council (ICC):

IPC-2018.....International Plumbing Code

H. Manufacturers Standardization Society (MSS):

SP-123-2018.....Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube

I. National Fire Protection Association (NFPA):

70-2020.....National Electrical Code (NEC)

J. Underwriters' Laboratories, Inc. (UL):

508-99 (R2013).....Standard For Industrial Control Equipment

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 13 00, FACILITY SANITARY AND VENT PIPING", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Piping.
2. Floor Drains.
3. Grease Removal Unit.
4. Cleanouts.
5. Trap Seal Protection.
6. Penetration Sleeves.
7. Pipe Fittings.
8. Traps.
9. Exposed Piping and Fittings.

D. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

Completed System Readiness Checklist provided by the CXA and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

F. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph "AS-BUILT DOCUMENTATION" of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 SANITARY WASTE, DRAIN, AND VENT PIPING

A. Cast iron waste, drain, and vent pipe and fittings.
   1. Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:
      a. Pipe buried in or in contact with earth.
      b. Sanitary pipe extensions to a distance of approximately 1500 mm (5 feet) outside of the building.
      c. Interior waste and vent piping above grade.
   2. Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).
   3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI 301, ASTM A888, or ASTM A74.
   4. Cast iron pipe and fittings shall be made from a minimum of 95 percent post-consumer recycled material.
   5. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM C564.

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.

C. Polyvinyl Chloride (PVC)

1. Polyvinyl chloride (PVC) pipe and fittings are permitted where the waste temperature is less than 60 degrees C (140 degrees F).
2. PVC piping and fittings shall NOT be used for the following applications:
   a. Waste collected from steam condensate drains.
   b. Spaces such as mechanical equipment rooms, kitchens, Sterile Processing Services, sterilizer areas, and areas designated for sleep.
   c. Vertical waste and soil stacks serving more than two floors.
   d. Exposed in mechanical equipment rooms.
   e. Exposed inside of ceiling return plenums.
3. Polyvinyl chloride sanitary waste, drain, and vent pipe and fittings shall be solid core sewer piping conforming to ASTM D2665, sewer and drain series with ends for solvent cemented joints.
4. Fittings: PVC fittings shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

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 or ASTM D2665.
3. Nipples shall conform to ASTM B687, Chromium-plated.
4. Unions shall be brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

B. In unfinished Rooms such as mechanical Rooms and Kitchens, Chrome-plated brass piping is not required. The pipe materials specified under the paragraph “Sanitary Waste, Drain, and Vent Piping” can be used. The sanitary pipe in unfinished rooms shall be painted as specified in Section 09 91 00, PAINTING.

2.4 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 PVC soil pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F477 or ASTM D5926.
3. 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 .45 kg (16-ounce) soft copper or 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 B (FD-B) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type B floor drain shall be constructed of galvanized cast iron with medium duty nickel bronze grate, double drainage pattern, clamping device, without sediment bucket but with secondary strainer in bottom for large debris. The grate shall be 175 mm (7 inches) minimum.

C. 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.

D. 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 with flange for membrane type flooring, integral reversible clamping device, seepage openings and 175 mm (7 inch) diameter or square satin nickel bronze or satin bronze strainer with 100 mm (4 inch) flange for toilet rooms, showers and kitchens.

E. Type E (FD-E) floor drain shall comply with ASME A112.6.3. The type E floor drain shall have a heavy, cast iron body, double drainage pattern, heavy non-tilting nickel bronze or ductile iron grate not less than 300 mm (12 inches) square, removable sediment bucket. Clearance between body and bucket shall be ample for free flow of waste water. For traffic use, an extra heavy duty load classification ductile iron grate shall be provided.

F. Type F (FD-F) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type F floor drain shall be have a cast iron body with flange, integral reversible clamping device, seepage openings and a 228 mm (9 inch) two-piece satin nickel-bronze or satin bronze strainer for use with seamless vinyl floors in toilet rooms and showers.

G. Type G (FD-G) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type G floor drain shall have a cast iron body, shallow type with double drainage flange and removable, perforated

aluminum sediment bucket. The type G drain shall have all interior and exposed exterior surfaces coated with acid resistant porcelain enamel finish. The floor drain shall have a clamping device. The frame and grate shall be nickel bronze. The grate shall be approximately 200 mm (8 inches) in diameter. The space between body of drain and basket shall be sufficient for free flow of waste water.

H. Type H (FD-H) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type H drain shall have a cast iron body, double drainage pattern, without sediment bucket but with loose set nickel bronze grate, secondary strainer, and integral clamping collar. The grate shall be 300 mm (12 inches) in diameter or 300 mm (12 inches) square. The drain body shall be 150 mm (6 inches) deep.

I. Type I (FD-I) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type I floor drain shall have a cast iron body, wide flange for seamless floor, double drainage pattern, with all interior surfaces and exposed exterior surfaces provided with acid resistant enamel finish for sanitary areas. The type I floor drain shall have a clamping device, secured nickel bronze rim, aluminum enameled finish sediment basket with, perforations with not less than 19,300 square mm (30 square inches) of free area. The sediment basket shall be approximately 100 mm (4 inches) deep, and be provided with grips for easy handling. The floor drain shall be provided with a loose-set, nickel bronze grate approximately 300 mm (12 inches) square and of sufficient strength to support pedestrian traffic. Ample space between body of drain and sediment basket shall be provided for free flow of waste liquids.

J. Type J (FD-J) floor drain shall comply with ASME A112.6.3. The type J floor drain shall be a flushing rim drain with heavy duty cast iron body, double drainage pattern with flushing rim and clamping device. The nickel bronze grate shall be approximately 280 mm (11 inches) in diameter and flush with floor. A deep-seal P-trap shall be attached to drain. The body and trap shall have pipe taps for water supply connections.

1. Drain Flange: Flange for synthetic flooring.
2. Flush Valve: Large diaphragm flushometer, exposed, side oscillating handle. For the flush valve mounting and installation detail, see the detail indicated in the contract documents.

K. Type K (FD-K) floor drain shall comply with ASME A112.6.3. The type K floor drain shall be a flushing Rim Drain with heavy duty cast iron body, double drainage pattern with flushing rim and clamping device. Solid bronze gasketed grate shall be approximately 280 mm (11 inches) in diameter, flush with floor. A deep-seal P-trap shall be attached to drain. Body and trap shall have pipe taps for water supply connections.
   1. 1. Drain Flange: Flange for synthetic flooring.
   2. 2. Flush Valve: Large diaphragm flushometer, exposed, side oscillating handle.

L. Type L (FD-L) floor drain shall comply with ASME A112.6.3. The type L floor drain shall be a flushing rim drain with heavy cast iron body, double drainage pattern with flushing rim and clamping device. Solid bronze gasketed grate shall be approximately 280 mm (11 inches) in diameter, with 50 mm (2 inch) length of 20 mm (3/4 inch) brass pipe brazed or threaded into the center of the solid grate. Pipe shall be threaded and provided with a brass cap with inter gasket (neoprene) to provide a gas tight installation. A deep-seal P-trap shall be attached to drain. Body and trap shall have pipe taps for water supply connections. Used in dialysis rooms.
   1. Drain Flange: Flange for synthetic flooring.
   2. Cystoscopy Rooms:
      a. Flush Valve: The flush valves shall be large diaphragm type flushometer, solenoid operated with a single-circuit timer. Mount in valve cabinet.
      b. Operation: Valve solenoid shall be cycled by a single-circuit timer set to operate flush valve at five minute intervals. Timer shall be electrically connected to an "on-off" toggle switch and be provided with pilot light. Timer and flush valve shall operate only when timer/valve switch is in the "on" position.
      c. Valve Cabinets:
         1) General: Sheet metal not lighter than 1.6 mm thick (16 gauge), size as required, rigidly assembled with joints welded, and punched or drilled for passage of required pipes and services. Provide anchors for fastening cabinet in place. Front shall be flush with wall finish and shall have flush fitting, hinged doors, with latch. Door shall be arranged to not offer any obstruction when open.

2) Doors and Trim: Flush with front of cabinet, constructed of not lighter than number 2.7 mm thick (12 gauge) steel. Doors shall open through 180 degrees and be provided with two butt hinges or continuous hinge. Latch shall be provided by manufacture of cabinet.
3) Painting: Prime and finish painting is specified under Section 09 91 00, PAINTING.

M. Type M (FD-M) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type M floor drain shall have a cast iron body, nickel bronze adjustable funnel strainer and clamping device. Funnel strainer shall consist of a perforated floor-level square or round grate and funnel extension for indirect waste. Cut-out grate below funnel. Minimum dimensions as follows:
1. Area of strainer and collar – 23,000 square mm (36 square inches).
2. Height of funnel – 95 mm (3-3/4 inches).
3. Diameter of lower portion of funnel – 50 mm (2 inches).
4. Diameter of top portion of funnel – 100 mm (4 inches).
5. Provide paper collars for construction purposes.

N. Type N (FD-N) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type N floor drain shall have a cast iron body, wide flange for seamless floors, double drainage pattern, with all interior and exposed exterior surfaces provided with acid resistant enamel finish for sanitary areas. The type N floor drain shall have a clamping device, secured nickel bronze rim, aluminum enameled finish sediment basket, perforated with not less than 9,000 square mm (14 square inches) of free area and approximately 50 mm (2 inches) deep. The sediment bucket shall be provided with grips for easy handling. The loose-set, nickel bronze grate approximately 200 mm (8 inches) shall be round and of sufficient strength to support pedestrian traffic. Ample space between body of drain and sediment basket shall be provided for free flow of waste liquids.

O. Type O (FD-O) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type O floor drain shall have a cast iron body, double drainage pattern, clamping device, less grate and sediment basket but with dome type secondary strainer. The drain shall be 300 mm (12 inches) in diameter or 300 mm (12 inches) square and approximately

150 mm (6 inches) deep. The interior and exposed exterior surfaces shall have an acid resisting, enamel finish for sanitary areas.

P. Type P (FD-P) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type P floor drain shall have a cast iron body, double drainage pattern, with all interior and exposed exterior surfaces provided with acid resistant enamel finish for sanitary areas. The type P floor drain shall have a clamping device, secured nickel bronze rim, an aluminum enameled finish sediment basket perforated with not less than 27,000 square mm (42 square inches) of free area and approximately 100 mm (4 inches) deep. The sediment bucket shall be provided with grips for easy handling. The loose-set, nickel bronze grate shall be approximately 7,700 square mm (12 square inches) and of sufficient strength to support pedestrian traffic. Ample space between body of drain and sediment basket shall be provided for free flow of waste liquids.

Q. Type R (FD-R) floor drain shall comply with ASME A112.6.3. The type R floor drain shall have a cast iron body, double drainage pattern and clamping device, less grate and sediment basket but with dome type secondary strainer. The drain shall be 200 mm (8 inches) in diameter or 200 mm (8 inches) square and approximately 150 mm (6 inches) deep. The interior and exposed exterior surfaces and rim shall have an acid resisting finish for indirect waste in sanitary areas.

R. Type S (FD-S) floor sink shall comply with ASME A112.6.3. The type S floor sink shall be constructed from type 304 stainless steel and shall be 300 mm (12 inches) square, and 200 mm (8 inches deep). The interior surface shall be polished. The double drainage flange shall be provided with weep holes, internal dome strainer, and heavy duty non-tilting loose set grate. A clamping device shall be provided.

S. Type T (FD-T) floor drain shall comply with ASME A112.6.3. The type T drain shall be Funnel Type, chemical resistant floor drain with integral p-trap. Double drainage pattern floor drain shall have an integral seepage pan for embedding in floor and weep holes to provide adequate drainage from pan to drain pipe. Floor drain shall be polypropylene, flame retardant, Schedule 40 or 80. An outlet of floor drain shall be suitable for properly jointing perforated or slotted floor-level grate and funnel extension. Cut-out grate below funnel. Minimum dimensions as follows:

1. Height of funnel – 95 mm (3-3/4 inches).
2. Diameter of lower portion of funnel – 50 mm (2 inches).
3. Diameter of top portion of funnel – 100 mm (4 inches).

T. Type V (FD-V) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3 The type V floor drain shall have an oval funnel and cast iron body. Funnel strainer shall consist of a slotted cast iron floor-level grate funnel extension. Cut-out grate below funnel. Minimum dimensions as follows:
1. Area of strainer and collar – 23,000 square mm (36 square inches).
2. Height of funnel – 95 mm (3-3/4 inches).
3. Funnel size - 90 by 228 mm (3-1/2 by 9 inches).

U. Type W (FD-W) Open Sight Drains (OSDs) for clear water wastes only:
1. OSD’s shall be the cast iron open hub type.
2. A cast iron drain standpipe shall be utilized for equipment with a high rate of discharge.

V. Type X (FD-X) floor drain shall comply with ASME A112.6.3. The type X floor drain shall be a chemical resistant floor drain and integral p-trap. Double drainage pattern floor drain shall have integral seepage pan for embedding in floor and weep holes to provide adequate drainage from pan to drain pipe. Floor drain shall be polypropylene, flame retardant, Schedule 40 or 80. An outlet of floor drain shall be suitable for properly joining a perforated or slotted floor level grate.

W. Type Y (FD-Y) floor drain shall comply with ASME A112.6.3. The type Y floor drain shall be suitable for parking decks and constructed of extra heavy duty, galvanized cast iron body with double drainage pattern. The extra heavy duty polished bronze grate shall be not less than 228 mm (9 inches) in diameter with seepage pan and combination membrane flashing clamp, heavy duty support flange, under deck clamp and vandal proof grate.

X. Type Z (FD-Z) trench drain shall comply with ASME A112.6.3. The type Z trench drain shall be suitable for shower thresholds and constructed of Type 304 stainless steel. The stainless steel slotted grate shall be not less than 100 mm (4 inches) wide with anchor supports, tile edge, bottom outlet and combination membrane flashing collar.

2.7 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 (TP-1): The trap seal primer system shall be electronic type conforming to ASSE 1044.
   1. The controller shall have a 24 hour programmable timer, solid state, 6 outlet zones, minimum adjustable run time of 1 minute for each zone, 12 hour program battery backup, manual switch for 120VAC power, 120VAC to 24VAC internal transformer, fuse protected circuitry, UL listed, 120VAC input-24VAC output, constructed of enameled steel or plastic.
   2. The cabinet shall be recessed mounting with a stainless steel cover.
   3. The solenoid valve shall have a brass body, suitable for potable water service, normally closed, 861 kPa (125 psig) rated, 24VAC.
   4. The control wiring shall be copper in accordance with the National Electric Code (NFPA 70), Article 725 and not less than 18 gauge. All wiring shall be in conduit and in accordance with Division 26 of the specifications.
   5. The vacuum breaker shall conform to ASSE 1001.

B. Trap Primer (TP-2): 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. Aboveground PVC piping shall be installed according to ASTM D2665. Underground PVC piping shall be installed according to ASTM D2321.

N. 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.

F. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendices.

3.3 SPECIALTY PIPE FITTINGS

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES

A. All piping shall be supported according to the International Plumbing Code (IPC), Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications. Where conflicts arise between these the code and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.

B. Hangers, supports, rods, inserts and accessories used for pipe supports shall be painted according to Section 09 91 00, PAINTING. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:

1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
2. 75 mm or DN75 (NPS 3 inch): 1500 mm (60 inches) with 15 mm (1/2 inch) rod.
3. 100 mm or DN100 to 125 mm or DN125 (NPS 4 inch to NPS 5 inch): 1500 mm (60 inches) with 18 mm (5/8 inch) rod.
4. 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 20 mm (3/4 inch) rod.
5. 250 mm or DN250 to 300 mm or DN300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 23 mm (7/8 inch) rod.

E. The maximum spacing for plastic pipe shall be 1.22 m (4 feet).

F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.6 m (15 feet).

G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, Floor, Wall and Ceiling Plates, 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.

H. 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.

I. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

J. Penetrations:

1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

K. Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

3.5 TESTS

A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.

B. Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

1. If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
2. For an air test, an air pressure of 34 kPa (5 psig) gauge shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gauge shall be used for the air test.
3. After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.
4. Final Tests: Either one of the following tests may be used.
   a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of .25 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.
   b. Peppermint Test: Introduce 60 ml (2 ounces) of peppermint into each line or stack.

3.6 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification shall be tested as part of a larger system.

3.7 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

- - - E N D - - -

SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Contractor shall tie into existing direct-digital control system(s) as indicated on the project documents, point list, interoperability tables, drawings and as described in these specifications.

B. Some products are furnished but not installed by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the installation of the products. These products include but are not limited to the following:

1. Control valves.
2. Flow switches.
3. Flow meters.

C. Responsibility Table:

Work/Item/System	Furnish	Install	Low Voltage Wiring	Line Power
Control system low voltage and communication wiring	23 09 23	23 09 23	23 09 23	N/A
Pipe insertion devices and taps, flow and pressure stations.	23	23	N/A	N/A
All control system nodes, equipment, housings, enclosures and panels.	23 09 23	23 09 23	23 09 23	26

1.2 RELATED WORK

A. Section 26 05 11, Requirements for Electrical Installations.

B. Section 26 05 26, Grounding and Bonding for Electrical Systems.

C. Section 26 05 33, Raceway and Boxes for Electrical Systems.

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 Integration subcontractor shall be responsible for the complete design, installation, integration, and commissioning of the system. The controls subcontractor shall be in the business of design, installation and service of such building automation control systems similar in size and complexity.
2. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer’s latest standard design and have been tested and proven in actual use.
3. The controls subcontractor shall provide a list of no less than five similar projects which have building control systems as specified in this Section. These projects must be on-line and functional such that the Department of Veterans Affairs (VA) representative could observe the control systems in full operation.
4. The controls subcontractor shall have an in-place facility within 100 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

1. Reporting Accuracy: Listed below are minimum acceptable reporting end-to-end accuracies for all values reported by the specified system:

Measured Variable	Reported Accuracy
Water temperature	±0.5 degrees C [±1 degrees F]
Water flow	±1 percent of reading
Water pressure	±2 percent of full scale *Note 1

Note 1: for both absolute and differential pressure

1.6 WARRANTY

A. Labor and materials for control systems shall be warranted for a period as specified under Warranty in FAR clause 52.246-21.

B. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no cost or reduction in service to the owner. The system includes all computer equipment, transmission equipment, and all sensors and control devices.

C. The on-line support service shall allow the Controls supplier to dial out over telephone lines to or connect via (through password-limited access) VPN through the internet to monitor and control the facility's building automation system. This remote connection to the facility shall be within two (2) hours of the time that the problem is reported. This coverage shall include normal business hours, after business hours, weekend and holidays. If the problem cannot be resolved with on-line support services, the Controls supplier shall dispatch the qualified personnel to the job site to resolve the problem within 8 hours after the problem is reported.

D. Controls subcontractor shall be responsible for temporary operations and maintenance of the control systems during the construction period until final commissioning, training of facility operators and acceptance of the project by VA.

1.7 SUBMITTALS

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

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including:

1. A wiring diagram for each type of input device and output device including DDC controllers, modems, repeaters, etc. Diagram shall show how the device is wired and powered, showing typical connections at the digital controllers and each power supply, as well as the device itself. Show for all field connected devices, including but not limited to, control relays, motor starters, electric or electronic actuators, and temperature pressure, flow and humidity sensors and transmitters.
2. A diagram of each terminal strip, including digital controller terminal strips, terminal strip location, termination numbers and the associated point names.
3. Catalog cut sheets of all equipment used. This includes, but is not limited to software (by manufacturer and by third parties), DDC controllers, panels, peripherals, airflow measuring stations and associated components, and auxiliary control devices such as sensors, actuators, and control dampers. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted. Each submitted piece of literature and drawings should clearly reference the specification and/or drawings that it supposed to represent.
4. Sequence of operations for each system and the associated control diagrams. Equipment and control labels shall correspond to those shown on the drawings.
5. Color prints of proposed graphics with a list of points for display.
6. Furnish a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet-compliant device.
7. 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.

8. 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.
9. Riser diagrams of wiring between central control unit (CCU) and all control panels.
10. Plan drawings showing routing of LAN and locations of control panels, controllers, routers, gateways, ECC, and larger controlled devices.
11. Construction details for all installed conduit, cabling, raceway, cabinets, and similar. Construction details of all penetrations and their protection.
12. Quantities of submitted items may be reviewed but it is the responsibility of the contractor administered by this Section of the technical specifications to provide sufficient quantities for a complete and working system.

D. Product Certificates: Compliance with Article, QUALITY ASSURANCE.

E. Validation Test Plan: Along with manufacturer's literature, product certificates, wiring and functional diagrams, and sequence of operations, submit for review and approval a Validation Test Plan which is specific to the work of this project and which references the specific controls component nomenclatures found in the control contractor's wiring and functional diagrams and the specific sequences of controls for this project and which describes how the contractor will implement the controls system validation and demonstration as specified in paragraph 3.2 SYSTEM VALIDATION AND DEMONSTRATION found in this section.

F. Licenses: Provide licenses for all software residing on and used by the Controls Systems, ECC, and portable OWS and transfer these licenses to the Owner prior to completion.

G. As Built Control Drawings:

1. Furnish three (3) copies of as-built drawings for each control system. The documents shall be submitted for approval prior to final completion.

2. Furnish one (1) set of applicable control system prints for each mechanical system for wall mounting. The documents shall be submitted for approval prior to final completion.
3. Furnish one (1) CD-ROM in CAD DWG and/or .DXF format for the drawings noted in subparagraphs above.

H. Operation and Maintenance (O/M) Manuals):
1. Submit in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS.
2. Include the following documentation:
   a. General description and specifications for all components, including logging on/off, alarm handling, producing trend reports, overriding computer control, and changing set points and other variables.
   b. Detailed illustrations of all the control systems specified for ease of maintenance and repair/replacement procedures, and complete calibration procedures.
   c. One copy of the final version of all software provided including operating systems, programming language, operator workstation software, and graphics software.
   d. Complete troubleshooting procedures and guidelines for all systems.
   e. Complete operating instructions for all systems.
   f. Recommended preventive maintenance procedures for all system components including a schedule of tasks for inspection, cleaning and calibration. Provide a list of recommended spare parts needed to minimize downtime.
   g. Training Manuals: Submit the course outline and training material to the Owner for approval three (3) weeks prior to the training to VA facility personnel. These persons will be responsible for maintaining and the operation of the control systems, including programming. The Owner reserves the right to modify any or all of the course outline and training material.
   h. Licenses, guaranty, and other pertaining documents for all equipment and systems.

I. Submit Performance Report to COR prior to final inspection.

1.8 INSTRUCTIONS

A. Instructions to VA operations personnel: Perform in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS, and as noted below. Contractor shall also video tape instruction sessions noted below.

1. First Phase: Formal instructions to the VA facilities personnel for a total of 8 hours, given in multiple training sessions (each no longer than four hours in length), conducted sometime between the completed installation and prior to the performance test period of the control system, at a time mutually agreeable to the Contractor and the VA.
2. Second Phase: This phase of training shall comprise of on the job training during startup, checkout period, and performance test period. VA facilities personnel will work with the Contractor's installation and test personnel on a daily basis during startup and checkout period. During the performance test period, controls subcontractor will provide 8 hours of instructions, given in multiple training sessions (each no longer than four hours in length), to the VA facilities personnel.
3. The O/M Manuals shall contain approved submittals as outlined in Article 1.7, SUBMITTALS. The Controls subcontractor will review the manual contents with VA facilities personnel during second phase of training.
4. Training shall be given by direct employees of THE CONTROLS system subcontractor.

1.9 PROJECT CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)

A. The ECC and peripheral devices and system support equipment shall be designed to operate in ambient condition of 20 to 35 degrees C (65 to 90 degrees F) at a relative humidity of 20 to 80 percent non-condensing.

B. The Controllers used outdoors shall be mounted in NEMA 4 waterproof enclosures, and shall be rated for operation at -40 to 65 degrees C (-40 to 150 degrees F).

C. All electronic equipment shall operate properly with power fluctuations of plus 10 percent to minus 15 percent of nominal supply voltage.

D. Sensors and controlling devices shall be designed to operate in the environment, which they are sensing or controlling.

1.10 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

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):

Rules and Regulations Title 47 Chapter 1-2014 Part 15: Radio Frequency Devices

D. Institute of Electrical and Electronic Engineers (IEEE):

802.3-2018.....Standard for Ethernet

E. National Fire Protection Association (NFPA):

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 SENSORS WATER

A. Sensors' measurements shall be read back to the DDC system, and shall be visible by the ECC.

B. Vortex Water flow sensors:

1. Type: Insertion vortex type with retractable probe assembly and 2 inch full port gate valve.
   a. Pipe size: up to 24 inches.
   b. Retractor: ASME threaded, non-rising stem type with hand wheel.
   c. Mounting connection: 2 inch 150 PSI flange.
   d. Sensor assembly: Design for expected water flow and pipe size.
   e. Seal: Teflon (PTFE).
2. Controller:
   a. Integral to unit.

b. Locally display flow rate and total.

c. Output flow signal to BAS/EMS/BES/BMCS: Digital pulse or BACnet type.

3. Performance:

a. Turndown: 20:1

b. Response time: Adjustable from 1 to 100 seconds.

c. Power: 24 volt AC

4. Install flow meters according to manufacturer's recommendations. Where recommended by manufacturer because of mounting conditions, provide flow rectifier

2.3 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 Section 26 05 26, Grounding and Bonding for Electrical Systems.
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. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Examine project plans for control devices and equipment locations; and report any discrepancies, conflicts, or omissions to COR for resolution before proceeding for installation.
   2. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
   3. Install all equipment and piping in readily accessible locations. Do not run tubing and conduit concealed under insulation or inside ducts.
   4. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
   5. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
   6. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
   7. Install equipment level and plumb.

B. Electrical Wiring Installation:
   1. All wiring and cabling shall be installed in conduits. Install conduits and wiring in accordance with Specification Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Conduits carrying control wiring and cabling shall be dedicated to the control wiring

and cabling: these conduits shall not carry power wiring. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.

2. Install 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.
3. 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.
4. 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.
5. Conceal cables, except in mechanical rooms and areas where other conduits and piping are exposed.
6. 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.
7. Grounding: ground electrical systems per manufacturer’s written requirements for proper and safe operation.

C. Install Sensors and Controls:

1. 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.

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. When formal commissioning is included in the project the system validation/test shall be part of the commissioning and shall be witnessed by the CxA.

B. Validation

1. Prepare and submit for approval a validation test plan including test procedures for the performance verification tests. Test Plan shall be submitted for review with the control system submittal as indicated in paragraph 1.7 Submittals. Test Plan address all specified functions of the ECC and all specified sequences of operation. Explain in detail actions and expected results used to demonstrate compliance with the requirements of this specification. Explain the method for simulating the necessary conditions of operation used to demonstrate performance of the system. Test plan shall include a test check list to be used by the Installer’s agent to check and initial that each test has been successfully completed. Deliver test plan documentation for the performance verification tests to the owner’s representative 30 days prior to start of performance verification tests. Provide draft copy of operation and maintenance manual with performance verification test.

2. After approval of the validation test plan, installer shall carry out all tests and procedures therein. Installer shall completely check out, calibrate, and test all connected hardware and software to ensure that system performs in accordance with approved

specifications and sequences of operation submitted. Installer shall complete and submit Test Check List.

C. Demonstration

1. System operation and calibration to be demonstrated by the installer in the presence of the Architect, CxA or COR on random samples of equipment as dictated by the COR. Should random sampling indicate improper work, the owner reserves the right to subsequently witness complete calibration of the system at no addition cost to the VA.
2. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.
3. The following witnessed demonstrations of field control equipment shall be included:

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.

- - - 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, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.

C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company’s system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company’s system, and obtain electric utility company approval for sizes and settings of these devices.

D. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

A. The latest International Building Code (IBC), Underwriters Laboratories, Inc. (UL), Institute of Electrical and Electronics Engineers (IEEE), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.

B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts,

certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified: Materials and equipment which:
   a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
   b. Are periodically inspected by a NRTL.
   c. Bear a label, tag, or other record of certification.
4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturer’s Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.

B. Product Qualification:

1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.

2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

A. Applicable publications listed in all Sections of Division 26 shall be the latest issue, unless otherwise noted.

B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.6 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available. Materials and equipment furnished shall be new, and shall have superior quality and freshness.

B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Tests are specified, Factory Tests shall be performed in the factory by the equipment manufacturer, and witnessed by the contractor. In addition, the following requirements shall be complied with:
   1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the Government through the COR a minimum of thirty (30) days prior to the manufacturer's performing of the factory tests.
   2. When factory tests are successful, contractor shall furnish four (4) copies of the equipment manufacturer's certified test reports to the COR fourteen (14) days prior to shipment of the equipment, and not more than ninety (90) days after completion of the factory tests.
   3. When factory tests are not successful, factory tests shall be repeated in the factory by the equipment manufacturer, and witnessed by the Contractor. The Contractor shall be liable for all additional expenses for the Government to witness factory re-testing.

1.7 VARIATIONS FROM CONTRACT REQUIREMENTS

A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 MATERIALS AND EQUIPMENT PROTECTION

A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold, freeze and rain.
   1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
   2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
   3. Damaged equipment shall be repaired or replaced, as determined by the COR.
   4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

A. All electrical work shall comply with requirements of the latest NFPA 70 (NEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, NFPA 780, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. However, energized electrical work may be performed only for the non-destructive and non-invasive diagnostic testing(s), or when scheduled outage poses an imminent hazard to patient care, safety, or physical security. In such case, all aspects of energized electrical work, such as the availability of appropriate/correct personal protective equipment (PPE) and the use of PPE, shall comply with the latest NFPA 70E, as well as the following requirements:

1. Only Qualified Person(s) shall perform energized electrical work. Supervisor of Qualified Person(s) shall witness the work of its entirety to ensure compliance with safety requirements and approved work plan.
2. At least two weeks before initiating any energized electrical work, the Contractor and the Qualified Person(s) who is designated to perform the work shall visually inspect, verify and confirm that the work area and electrical equipment can safely accommodate the work involved.
3. At least two weeks before initiating any energized electrical work, the Contractor shall develop and submit a job specific work plan, and energized electrical work request to the COR, and Medical Center’s Chief Engineer or his/her designee. At the minimum, the work plan must include relevant information such as proposed work schedule, area of work, description of work, name(s) of Supervisor and Qualified Person(s) performing the work, equipment to be used, procedures to be used on and near the live electrical equipment,

barriers to be installed, safety equipment to be used, and exit pathways.

4. Energized electrical work shall begin only after the Contractor has obtained written approval of the work plan, and the energized electrical work request from the COR, and Medical Center's Chief Engineer or his/her designee. The Contractor shall make these approved documents present and available at the time and place of energized electrical work.
5. Energized electrical work shall begin only after the Contractor has invited and received acknowledgment from the COR, and Medical Center's Chief Engineer or his/her designee to witness the work.

D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working spaces or working clearances shall comply with NEC's requirements, at a minimum.

C. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

1.11 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

C. Install adhesive arc flash warning labels on all equipment as required by the latest NFPA 70E. Label shall show specific and correct information for specific equipment based on its arc flash calculations. Label shall show the followings:

1. Nominal system voltage.
2. Equipment/bus name, date prepared, and manufacturer name and address.
3. Arc flash boundary.
4. Available arc flash incident energy and the corresponding working distance.
5. Minimum arc rating of clothing.
6. Site-specific level of PPE.

1.12 SUBMITTALS

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

B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.

C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.

E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion, etc.) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions may be designed and attached to the equipment.

3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:

1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
   b. A control sequence describing start-up, operation, and shutdown.
   c. Description of the function of each principal item of equipment.
   d. Installation instructions.
   e. Safety precautions for operation and maintenance.
   f. Diagrams and illustrations.
   g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
   h. Performance data.
   i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
   j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and

maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the COR with one sample of each of the following:

1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.
4. Duct sealing compound.
5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.14 ACCEPTANCE CHECKS AND TESTS

A. The Contractor shall furnish the instruments, materials, and labor for tests.

B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer’s representatives and technicians so that a complete, functional, and operational system is delivered to the Government.

C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests for the equipment. Repair, replacement, and re-testing shall be accomplished at no additional cost to the Government.

1.15 WARRANTY

A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of

one year from the date of acceptance of the entire installation by the COR 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)

- - - E N D - - -

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.

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.

D. Conductor Color Code:

1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
   a. Solid color insulation or solid color coating.
   b. Stripes, bands, or hash marks of color specified.
   c. Color using 19 mm (0.75 inches) wide tape.
3. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
4. Conductors shall be color-coded as follows:

208/120 V	Phase	
Black	A	
Red	B	
Blue	C	
White	Neutral	
* or white with colored (other than green) tracer.		

5. Lighting circuit “switch legs”, and 3-way and 4-way switch “traveling wires,” shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COR.
6. Color code for isolated power system wiring shall be in accordance with the NEC.

2.2 SPLICES

A. Splices shall be in accordance with NEC and UL.

B. Above Ground Splices for No. 10 AWG and Smaller:

1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.

2. The integral insulator shall have a skirt to completely cover the stripped conductors.
3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

C. 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/cadmium-plated steel.

2.4 CONTROL WIRING

A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG, or as required by the control wiring equipment manufacturer.

B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.5 WIRE LUBRICATING COMPOUND

A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

B. Shall not be used on conductors for isolated power systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer’s instructions.

B. Install conductors in raceway systems.

C. Splice conductors only in outlet boxes, junction boxes, and pullboxes.

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 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.

3.3 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, and pullboxes. 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.

3.4 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.

3.5 EXISTING CONDUCTORS

A. Unless specifically indicated on the plans, existing conductors shall not be reused.

3.6 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.

3.7 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.

3.8 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.

- - - E N D - - -

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.

B. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.

C. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

D. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
2. Test Reports:
   a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COR.

3. Certifications:

a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

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.

D. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

2.2 GROUND CONNECTIONS

A. 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/cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated/cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated/cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.3 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks. 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.

2.4 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with zinc-plated/cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.

B. System Grounding:

1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.
2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

D. For patient care area electrical power system grounding, conform to the latest NFPA 70 and 99.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.3 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. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide

a grounding electrode conductor from the transformer to the nearest component of the grounding electrode system.

3.4 RACEWAY

A. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and all branch circuits.

C. Boxes, Cabinets, and Enclosures:

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. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

G. Raised Floors: Provide bonding for all raised floor components as shown on the drawings.

H. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG, installed in rigid metal conduit.

3.5 CORROSION INHIBITORS

A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.6 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

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.

3.7 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.

B. Grounding system resistance shall comply with the electric utility company ground resistance requirements.

3.8 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.

3.9 ACCEPTANCE CHECKS AND TESTS

A. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized or connected to the electric utility company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.

B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- - - E N D - - -

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 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.

B. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

C. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.

D. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Conduits bracing.

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.

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 .75 inches unless otherwise shown.

B. Conduit:

1. Size: In accordance with the NEC, but not less than .75 inches.
2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and NEMA C80.1.
3. 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.
4. Flexible Metal Conduit: Shall conform to UL 1.
5. Liquid-tight Flexible Metal Conduit: Shall conform to UL 360.

C. Conduit Fittings:

1. Rigid Steel 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: Are prohibited.
   f. Sealing Fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
2. Electrical Metallic Tubing Fittings:
   a. Fittings and conduit bodies shall meet the requirements of UL 514B, NEMA C80.3, and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Compression Couplings and Connectors: Concrete-tight and rain-tight, with connectors having insulated throats.
   d. Set Screw Couplings and Connectors: Are prohibited.
   e. Indent-type connectors or couplings are prohibited.
   f. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
3. Flexible Metal Conduit Fittings:
   a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   b. Clamp-type, with insulated throat.
4. Liquid-tight Flexible Metal Conduit Fittings:
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.

c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

5. 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. 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. 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 600 V and Below: Rigid steel. Mixing different types of conduits in the same system is prohibited.
2. Align and run conduit parallel or perpendicular to the building lines.
3. 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.
4. 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 600 V and Below: Rigid steel. Mixing different types of conduits in the system is prohibited.
C. Align and run conduit parallel or perpendicular to the building lines.
D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
E. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals.
F. Surface Metal Raceways: Use only where shown on drawings.

G. Painting:

1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (2 inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6 M (20 feet) intervals in between.

3.5 HAZARDOUS LOCATIONS

A. Use rigid steel conduit only.

B. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.6 WET OR DAMP LOCATIONS

A. Use rigid steel.

B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.

C. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

D. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut. Conduits shall be attached to steel channel with conduit clamps.

3.7 MOTORS AND VIBRATING EQUIPMENT

A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.

B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water.

C. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

3.8 EXPANSION JOINTS

A. Conduits 75 mm (3 inch) and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inch) with junction boxes on both sides of the expansion joint. Connect flexible metal conduits to junction boxes with sufficient slack to produce a 125 mm (5 inch) vertical drop midway between the ends of the flexible metal conduit. Flexible metal conduit shall have a green insulated copper bonding jumper installed. In lieu of this flexible metal conduit, expansion and deflection couplings as specified above are acceptable.

C. Install expansion and deflection couplings where shown.

D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 375 mm (15 inches) of slack flexible conduit. Flexible conduit shall have a copper bonding jumper installed.

3.9 CONDUIT SUPPORTS

A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and an additional 90 kg (200 lbs). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.

2. Existing Construction:
   a. Steel expansion anchors not less than 6 mm (0.25-inch) bolt size and not less than 28 mm (1.125 inch) in embedment.
   b. Power set fasteners not less than 6 mm (0.25-inch) diameter with depth of penetration not less than 75 mm (3 inch).
   c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts.

G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.

L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.10 BOX INSTALLATION

A. Boxes for Concealed Conduits:
   1. Flush-mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.

C. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.

D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.

F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.

H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "ELECTRICAL PB No. 1."

I. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL
1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of panelboards.

1.2 RELATED WORK

A. Section 09 91 00, PAINTING: Painting of panelboards.
B. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of non-structural components.
C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
D. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
F. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

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 and associated devices shall be in accordance with NEC, NEMA, UL, as specified, and as shown on the drawings.

2.2 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.
10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory accordingly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer’s instructions, the NEC, as shown on the drawings, and as specified.

B. Locate panelboards so that the present and future conduits can be conveniently connected.

C. In seismic areas, panelboards shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.

D. Install a printed schedule of circuits in each panelboard after approval by the COR. Schedules shall reflect final load descriptions, room numbers, and room names connected to each circuit breaker. Schedules shall be printed on the panelboard directory cards and be installed in the appropriate panelboards

E. Mount panelboards such that the maximum height of the top circuit breaker above the finished floor shall not exceed 1980 mm (78 inches).

F. Provide blank cover for each unused circuit breaker mounting space.

G. Rust and scale shall be removed from the inside of existing enclosures where new interior components are to be installed. Paint inside of enclosures with rust-preventive paint before the new interior components are installed. Provide new trim. Trim shall fit tight to the enclosure.

H. Panelboard enclosures shall not be used for conductors feeding through, spliced, or tapping off to other enclosures or devices.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests:

a. Compare equipment nameplate data with specifications and approved shop drawings.

b. Inspect physical, electrical, and mechanical condition.

c. Verify appropriate anchorage and required area clearances.

d. Verify that circuit breaker sizes and types correspond to approved shop drawings.

e. To verify tightness of accessible bolted electrical connections, use the calibrated torque-wrench method or perform thermographic survey after energization.

f. Vacuum-clean enclosure interior. Clean enclosure exterior.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall demonstrate that the panelboards are in good operating condition and properly performing the intended function.

- - - E N D - - -

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.

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. For all receptacles installed within wet or damp locations the receptacles shall be GFCI type and shall be installed within a NEMA rated enclosure.

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.

C. Surge Protective Receptacles shall have integral surge suppression in line to ground, line to neutral, and neutral to ground modes.

1. Surge Protective Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 Volts, and minimum single transient pulse energy dissipation of 210 Joules.
2. Active Surge Protective Indication: LED, visible in face of device to indicate device is active or no longer in service.2.2 TOGGLE SWITCHES

D. 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.

2.2 WALL PLATES

A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.

B. Color shall be ivory unless otherwise specified.

C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

D. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.

E. Duplex Receptacles on Emergency Circuit: Wall plates shall be type 302 stainless steel, with the word "EMERGENCY" engraved in 6 mm (1/4 inch) red letters.

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.

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.

- - - 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.

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. 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.
12. Grounding Electrode Conductor: (GEC) Conductor connected to earth grounding electrode.
13. Grounding Electrode System: Electrodes through which an effective connection to earth is established, including supplementary, communications system grounding electrodes and GEC.
14. Grounding Equalizer or Backbone Bonding Conductor (BBC): Conductor that interconnects elements of telecommunications grounding infrastructure.
15. 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.
16. Microducts: All forms of air blown fiber pathways.
17. Ohm: A unit of restive measurement.
18. Received Signal Strength Indication (RSSI): A measurement of power present in a received RF signal.
19. Service Provider Demarcation Point (SPDP): Not owned by LEC or service provider, but designated by Government as point within facility considered the DEMARC.

20. Sound (SND): Changing air pressure to audible signals over given time span.
21. System: Specific hardware, firmware, and software, functioning together as a unit, performing task for which it was designed.
22. 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.
23. 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.
24. 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 6 Individually Unshielded Twisted Pair Indoor Cables (With or Without an Overall Shield) for use in Communications Wiring Systems Technical Requirements

11. Institute of Electrical and Electronics Engineers (IEEE):

ISSN 0739-5175	March-April 2008 Engineering in Medicine and Biology Magazine, IEEE (Volume: 27, Issue:2) Medical Grade-Mission Critical-Wireless Networks
IEEE C2-2012	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 6 Cabling to Support 10GBASE-T (2010)
TIA TSB-162-A	Telecommunications Cabling Guidelines for Wireless Access Points (2013)
TIA-222-G	Structural Standard for Antenna Supporting Structures and Antennas (2014)
TIA/EIA-423-B	Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits (2012)

TIA-455-C	General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components (August 2014)
TIA-455-53-A	FOTP-53 Attenuation by Substitution Measurements for Multimode Graded-Index Optical Fibers in Fiber Assemblies (Long Length) (September 2001)
TIA-455-61-A	FOTP-61 Measurement of Fiber of Cable Attenuation Using an OTDR (July 2003)
TIA-472D000-B	Fiber Optic Communications Cable for Outside Plant Use (July 2007)
ANSI/TIA-492-B	62.5-µ Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (November 2009)
ANSI/TIA-492AAAB-A	50-um Core Diameter/125-um Cladding Diameter Class IA Graded-Index Multimode Optically Optimized American Standard Fibers (November 2009
TIA-492CAAA	Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers (September 2002)
TIA-492E000	Sectional Specification for Class IVd Nonzero-Dispersion Single-Mode Optical Fibers for the 1,550 nm Window (September 2002)
TIA-526-7-B	Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7 (December 2008)
TIA-526.14-A	Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – SFSTP-14 (August 1998)
TIA-568	Revision/Edition: C Commercial Building Telecommunications Cabling Standard Set: (TIA-568-C.0-2 Generic Telecommunications Cabling for Customer Premises (2012), TIA-568-C.1-1 Commercial Building Telecommunications Cabling

	Standard Part 1: General Requirements (2012), TIA-568-C.2 Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted Pair Cabling Components (2009), TIA-568-C.3-1 Optical Fiber Cabling Components Standard, (2011) AND TIA-568-C.4 Broadband Coaxial Cabling and Components Standard (2011) with addendums and erratas
TIA-569	Revision/Edition C Telecommunications Pathways and Spaces (March 2013)
TIA-574	Position Non-Synchronous Interface between Data Terminal equipment and Data Circuit Terminating Equipment Employing Serial Binary Interchange (May 2003)
TIA/EIA-590-A	Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant (July 2001)
TIA-598-D	Optical Fiber Cable Color Coding (January 2005)
TIA-604-10-B	Fiber Optic Connector Intermateablility Standard (August 2008)
ANSI/TIA-606-B	Administration Standard for Telecommunications Infrastructure (2012)
TIA-607-B	Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises (January 2013)
TIA-613	High Speed Serial Interface for Data Terminal Equipment and Data Circuit Terminal Equipment (September 2005)
ANSI/TIA-758-B	Customer-owned Outside Plant Telecommunications Infrastructure Standard (April 2012)
ANSI/TIA-854	A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling (2001)
ANSI/TIA-862-A	Building Automation Systems Cabling Standard (April 2011)
TIA-942-A	Telecommunications Infrastructure Standard for Data Centers (March 2014)

TIA-1152	Requirements for Field Testing Instruments and Measurements for Balanced Twisted Pair Cabling (September 2009)
TIA-1179	Healthcare Facility Telecommunications Infrastructure Standard (July 2010)

1.4 SINGULAR NUMBER

A. Where any device or part of equipment is referred in singular number (such as " rack"), reference applies to as many such devices as are required to complete installation.

1.5 RELATED WORK

A. Specification Order of Precedence: FAR Clause 52.236-21, VAAR Clause 852.236-71.

1. Field Cutting and Patching: Section 09 91 00, PAINTING.
2. Additional submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
3. Availability and source of references and standards specified in applicable publications: Section 01 42 19, REFERENCE STANDARDS.
4. Requirements for non-hazardous building construction and demolition waste: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
5. 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.
6. Sealant and caulking materials and their application: Section 07 92 00, JOINT SEALANTS.
7. General electrical requirements that are common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
8. Electrical conductors and cables in electrical systems rated 600 V and below: Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
9. 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.
10. Conduit and boxes: Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Assign a single communications project manager to serve as point of contact for Government, contractor, and design professional.

B. Be proactive in scheduling work.

1. Use of premises is restricted at times directed by COR.
2. Movement of materials: Unload materials and equipment delivered to site.
3. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
4. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work.
5. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies; provide required connection for each service.
6. Initiate and maintain discussion regarding schedule for ceiling construction and install cables to meet that schedule.

C. 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/IVtwisted 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.
   h. Time domain reflectometer (TDR) with strip chart recorder (Data and Optical Measuring).
   i. Spectrum analyzer.
   j. Color video monitor with audio capability.
   k. Video waveform monitor.
   l. Video vector scope.
   m. 100 MHz oscilloscope with video adapters.
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 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. 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. Provide gel filled cable meeting requirements of ICEA S-99-689 and RUS 1755.390/RUS 1755.890.

F. In Vault or Manhole:

1. Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound
2. Closure must be suitable thermoplastic, thermo-set, or stainless steel material supplying structural strength to pass mechanical and electrical requirements in a vault or maintenance hole (manhole) environment.

G. Re-Enterable Encapsulating Compound: Product maintaining chemical stability of closure.

H. Provide gel-filled splice cases in accordance with RUS Bull 345-72.

1. paths.

2.7 ACCESS PANELS

A. Panels: 304 mm x 304 mm (12 inches by 12 inches), or size allowed by location to provide optimum access to equipment for maintenance and service.

B. Provide access panels and doors as required to allow service of materials and equipment that require inspection, replacement, repair or service.

C. Provide access panels where items installed require access and are concealed in floor, wall, furred space or above ceiling; ceilings consisting of lay-in or removable splined tiles do not require access panels.

D. Provide access panels with same fire rating classification as surface penetrated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Penetrations and Sleeves:

1. Lay out penetration and sleeve openings in advance, to permit provision in work.
2. Set sleeves in forms before concrete is poured.
3. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts, etc.
4. Provide sleeves and packing materials at penetrations of foundations, walls, slabs, partitions, and floors.

5. Make sleeves that penetrate outside walls, basement slabs, footings, and beams waterproof.
6. Fill slots, sleeves and other openings in floors or walls if not used.
   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/T568A pin assignments and cabling connections are in compliance with TIA standards.

6. Visually confirm minimum Category 6 unless otherwise noted or directed by the VA COR 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 DAS equipment for detailed proof of performance testing until 100 percent of system has been tested and found to meet requirements of the construction documents.
2. Government’s Condition of Acceptance of System Language:
   a. Without Acceptance: Until system fully meets conditions of construction documents, system’s ownership, use, operation and warranty commences at Government’s final acceptance date.
   b. With Conditional Acceptance: Stating conditions that need to be addressed by contractor or OEM and stating system’s use and operation to commence immediately while its warranty commences only at Government’s agreed final extended acceptance date.

c. With Full Acceptance: Stating system’s ownership, use, operation and warranty to immediately commence at Government’s agreed to date of final acceptance.

L. Acceptance Test Conclusion: Reschedule testing on deficiencies and shortages with COR, after COR and SMCS AHJ jointly agree to results of the test, using the generated punch list or discrepancy list. Perform retesting to comply with these specifications at contractor's expense.

M. Proof of Performance Certification:

1. If system is declared acceptable, AHJ (SMCS 005OP2H3) provides COR notice stating system processes to required operating standards and functions and is Government accepted for use by facility.
2. Validate items with COR needing to be provided to complete project contract (i.e. charts & diagrams, manuals, spare parts, system warranty documents executed, etc.). Once items have been provided, COR contacts FMS service chief to turn over system from CFM oversight for beneficial use by facility.
3. If system is declared unacceptable without conditions, rescheduled testing expenses are to be borne by contractor.

3.7 CLEANING

A. Remove debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from project site and clean work area, prior to final inspection and acceptance of work.

B. Put building and premises in neat and clean condition.

C. Remove debris on a daily basis.

D. Remove unused material, during progress of work.

E. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of COR.

F. Clean exterior surface of all equipment, including concrete residue, dirt, and paint residue, after completion of project.

G. Perform final cleaning prior to project acceptance by COR.

H. Remove paint splatters and other spots, dirt, and debris; touch up scratches and mars of finish to match original finish.

I. Clean devices internally using methods and materials recommended by manufacturer.

J. Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws and bolts according to equipment manufacturer’s published torque tightening values for equipment connectors. In absence

of published connection or terminal torque values, comply with torque values specified in UL 486A-486B.

3.8 TRAINING

A. Provide training in accordance with subsection, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

B. Provide training for equipment or system as required in each associated specification.

C. Develop and submit training schedule for approval by COR, at least 30 days prior to planned training.

3.9 PROTECTION

A. Protection of Fireproofing:

1. Install clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed, if possible, prior to start of spray fireproofing work.
2. Install conduits and other items that would interfere with proper application of fireproofing after completion of spray fire proofing work.
3. Patch and repair fireproofing damaged due to cutting or course of work must be performed by installer of fireproofing and paid for by trade responsible for damage.

B. Maintain equipment and systems until final acceptance.

C. Ensure adequate protection of equipment and material during installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

- - - E N D - - -

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section identifies common and general grounding and bonding requirements of communication installations and applies to all sections of Divisions 27.

1.2 RELATED WORK

A. Low voltage wiring: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.

1.3 SUBMITTALS

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. Provide plan indicating location of system grounding electrode connections and routing of aboveground and underground grounding electrode conductors.

C. Closeout Submittals: In addition to Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS provide the following:

1. Certified test reports of ground resistance.
2. Certifications: Two weeks prior to final inspection, submit following to COR:
   a. Certification materials and installation is in accordance with construction documents.
   b. Certification complete installation has been installed and tested.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Grounding and Bonding Conductors:

1. Provide UL 83 insulated stranded copper equipment grounding conductors, with the exception of solid copper conductors for sizes 6 mm² (10 AWG) and smaller. Identify all grounding conductors with continuous green insulation color, except identify wire sizes 25 mm² (4 AWG) and larger per NEC.
2. Provide ASTM B8 bare stranded copper bonding conductors, with the exception of ASTM B1 solid bare copper for wire sizes 6 mm² (10 AWG) and smaller.

B. Ground Rods:
   1. Copper clad steel, 19 mm (3/4-inch) diameter by 3000 mm (10 feet) long, conforming to UL 467.
   2. Provide quantity of rods required to obtain specified ground resistance.

C. Splices and Termination Components: Provide components meeting or exceeding UL 467 and clearly marked with manufacturer's name, catalog number, and permitted conductor sizes.

D. Telecommunication System Ground Busbars:
   1. Telecommunications Main Grounding Busbar (TMGB):
      a. 6.4 mm (1/4 inch) thick solid copper bar.
      b. Minimum 100 mm (4 inches) high and length sized in accordance application requirements and future growth of minimum 510 mm (20 inches) long.
      c. Minimum thirty predrilled attachment points (two rows of fifteen each) for attaching standard sized two-hole grounding lugs.
         1) 27 lugs with 15.8 mm (5/8 inch) hole centers.
         2) 3 lugs with 25.4 mm (1 inch) hole centers.
      d. Wall-mount stand-off brackets, assembly screws and insulators for 100 mm (4 inches) standoff from wall.
      e. Listed as grounding and bonding equipment.
   2. Telecommunications Grounding Busbar (TGB):
      a. 6.4 mm (1/4 inch) thick solid copper bar.
      b. Minimum 50 mm (2 inches) high and length sized in accordance application requirements and future growth of minimum 300 mm long (12 inches) long.
      c. Minimum nine predrilled attachment points (one row) for attaching standard sized two-hole grounding lugs.
         1) 6 lugs with 15.8 mm (5/8 inch) hole centers.
         2) 3 lugs with 25.4 mm (1 inch) hole centers.
      d. Wall-mount stand-off brackets, assembly screws and insulators for 100 mm (4 inches) standoff from wall.
      e. Listed as grounding and bonding equipment.

E. Equipment Rack and Cabinet Ground Bars:
   1. Solid copper ground bars designed for horizontal mounting to framework of open racks or enclosed equipment cabinets:
      a. 4.7 mm (3/16 inch) thick by 19.1 mm (3/4 inch) high hard-drawn electrolytic tough pitch 110 alloy copper bar.
      b. 482 mm (19 inches) or 584 mm (23 inches) EIA/ECA-310-E rack mounting width (as required) for mounting on racks or cabinets.
      c. Eight 6-32 tapped ground mounting holes on 25.4 mm (1 inch) intervals.
      d. Four 7.1 mm (0.281 inch) holes for attachment of two-hole grounding lugs.
      e. Copper splice bar of same material to transition between adjoining racks.
      f. Two each 12-24 x 19.1 mm (3/4 inch) copper-plated steel screws and flat washers for attachment to rack or cabinet.
      g. Listed as grounding and bonding equipment.
   2. Solid copper ground bars designed for vertical mounting to framework of open racks or enclosed equipment cabinets:
      a. 1.3 mm (0.05 inch) thick by 17 mm (0.68 inch) wide tinned copper strip.
      b. 1997 mm (78 inches) high for mounting vertically on full height racks.
      c. Holes punched on 15.875 mm-15.875 mm-12.7 mm (5/8”-5/8”-1/2”) alternating vertical centers to match EIA/ECA-310-E Universal Hole Pattern for a 45 RMU rack.
      d. Three #12-24 zinc-plated thread forming hex washer head installation screws, an abrasive pad and antioxidant joint compound.
      e. NRTL listed as grounding and bonding equipment.

F. Ground Terminal Blocks: Provide screw lug-type terminal blocks at equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted.
   1. Electroplated tin aluminum extrusion.
   2. Accept conductors ranging from #14 AWG through 2/0.
   3. Hold conductors in place by two stainless steel set screws.
   4. Two 6 mm (1/4 inch) holes spaced on 15.8 mm (5/8 inch) centers to allow secure two-bolt attachment.

5. Listed as a wire connector.

G. Splice Case Ground Accessories: Provide splice case grounding and bonding accessories manufactured by splice case manufacturer when available. Otherwise, use 16 mm² (6 AWG) insulated ground wire with shield bonding connectors.

H. Irreversible Compression Lugs:
1. Electroplated tinned copper.
2. Two holes spaced on 15.8 mm (5/8 inch) or 25.4 mm (1 inch) centers.
3. Sized to fit the specific size conductor.
4. Listed as wire connectors.

I. Antioxidant Joint Compound: Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Exterior Equipment Grounding: Bond exterior metallic components (including masts and cabinets), antennas, satellite dishes, towers, raceways, primary telecommunications protector/arresters, secondary surge protection, waveguides, cable shields, down conductors and other conductive items to directly to Intersystem Bonding Termination.

B. Install telecommunications bonding backbone conductor throughout building via telecommunications backbone pathways effectively bonding all interior telecommunications grounding busbars in telecommunications rooms, to telecommunications main grounding busbar in Demarc room after testing bond to verify bonding conductor for telecommunications from grounding electrode conductor is installed per NEC. Size telecommunications bonding backbone conductor as specified in TIA-607-B.

C. Inaccessible Grounding Connections: Utilize exothermic welding for bonding of buried or otherwise inaccessible connections with the exception of connections requiring periodic testing.

D. Conduit Systems:
1. Bond ferrous metallic conduit to ground.
2. Bond grounding conductors installed in ferrous metallic conduit at both ends of conduit using grounding bushing with #6 AWG conductor.

E. Boxes, Cabinets, and Enclosures:
1. Bond each pull box, splice box, equipment cabinet, and other enclosures through which conductors pass (except for special

grounding systems for intensive care units and other critical units shown) to ground.

F. Corrosion Inhibitors: Apply corrosion inhibitor for protecting connection between metals used to contact surfaces, when making ground and ground bonding connections.

G. Telecommunications Grounding System:

1. Bond telecommunications grounding systems and equipment to facility's electrical grounding electrode at Intersystem Bonding Termination.
2. Provide hardware as required to effectively bond metallic cable shields communications pathways, cable runway, and equipment chassis to ground.
3. Install bonding conductors without splices using shortest length of conductor possible to maintain clearances required by NEC.
4. Provide paths to ground that are permanent and continuous with a resistance of 1 ohm or less from each raceway, cable tray, and equipment connection to telecommunications grounding busbar.
5. Below-Grade Connections: When making exothermic welds, wire brush or file the point of contact to a bare metal surface. Use exothermic welding cartridges and molds in accordance with manufacturer's recommendations. After welds have been made and cooled, brush slag from weld area and thoroughly clean joint areas. Notify COR prior to backfilling at ground connections.
6. Above-Grade Bolted or Screwed Grounding Connections:
   a. Remove paint to expose entire contact surface by grinding.
   b. Clean all connector, plate and contact surfaces.
   c. Apply corrosion inhibitor to surfaces before joining.
7. Bonding Jumpers:
   a. Assemble bonding jumpers using insulated ground wire of size and type shown on drawings or use a minimum of 16 mm^2 (6 AWG) insulated copper wire terminated with compression connectors of proper size for conductors.
   b. Use connector manufacturer's compression tool.
8. Bonding Jumper Fasteners:
   a. Conduit: Connect bonding jumpers using lugs on grounding bushings or clamp pads on push-type conduit fasteners. Where appropriate, use zinc-plated external tooth lockwashers or Belleville Washers.

b. Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lockwashers or Belleville washers and nuts. Install protective cover, e.g., zinc-plated acorn nuts, on bolts extending into wireway or cable tray to prevent cable damage.

c. Grounding Busbars: Fasten bonding conductors using two-hole compression lugs. Use 300 series stainless steel bolts, Belleville Washers, and nuts.

d. Slotted Channel Framing and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and Belleville washers or external tooth lock washers.

H. Telecommunications Room Bonding:

1. Telecommunications Grounding Busbars:

a. Install busbar hardware no less than 950 mm (18 inches) A.F.F.

b. Where other grounding busbars are located in same room, e.g. electrical panelboard for telecommunications equipment, bond busbars together as indicated on grounding riser diagrams.

c. Make conductor connections with two-hole compression lugs sized to fit busbar and conductors.

d. Attach lugs with stainless steel hardware after preparing bond according to manufacturer recommendations and treating bonding surface on busbar with anti-oxidant to help prevent corrosion.

2. Telephone-Type Cable Rack Systems:

a. Aluminum pan installed on telephone-type cable rack serves as primary ground conductor within communications room.

b. Make ground connections by installing bonding jumpers:

1) Install minimum 16 mm² (6 AWG) bonding between telecommunications ground busbars and the aluminum pan installed on cable rack.

2) Install 16 mm² (6 AWG) bonding jumpers across aluminum pan junctions.

I. Self-Supporting and Cabinet-Mounted Equipment Rack Ground Bars:

1. Install rack-mount horizontal busbar or vertical busbar to provide multiple bonding points,

2. At each rack or cabinet containing active equipment or shielded cable terminations:

a. Bond busbar to ground as part of overall telecommunications bonding and grounding system.

b. Bond copper ground bars together using solid copper splice plates manufactured by same ground bar manufacturer, when ground bars are provided at rear of lineup of bolted together equipment racks.

c. Bond non-adjacent ground bars on equipment racks and cabinets with 16 mm² (6 AWG) insulated copper wire bonding jumpers attached at each end with compression-type connectors and mounting bolts.

d. Provide 16 mm² (6 AWG) bonding jumpers between rack and cabinet ground busbars and overhead cable runway or raised floor stringers, as appropriate.

J. Backboards: Provide a screw lug-type terminal block or drilled and tapped copper strip near top of backboards used for communications cross-connect systems. Connect backboard ground terminals to cable runway using an insulated 16 mm² (6 AWG) bonding jumper.

K. Other Communication Room Ground Systems: Ground metallic conduit, wireways, and other metallic equipment located away from equipment racks or cabinets to cable tray or telecommunications ground busbar, whichever is closer, using insulated 16 mm² (6 AWG) ground wire bonding jumpers.

L. Communications Cable Grounding:

1. Bond all metallic cable sheaths in multi-pair communications cables together at each splicing or terminating location to provide 100 percent metallic sheath continuity throughout communications distribution system.
2. Install a cable shield bonding connector with a screw stud connection for ground wire, at terminal points. Bond cable shield connector to ground.
3. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or splice case manufacturer’s splice case grounding and bonding accessories. When an external ground connection is provided as part of splice closure, connect to an effective ground source and bond all other metallic components and equipment at that location.

M. Communications Cable Tray Systems:

1. Bond metallic structures of cable tray to provide 100 percent electrical continuity throughout cable tray systems.

2. Where metallic cable tray systems are mechanically discontinuous:
   a. Install splice plates provided by cable tray manufacturer between cable tray sections so resistance across a bolted connection is 0.010 ohms or less, as verified by measuring across splice plate connection.
   b. Install 16 mm² (6 AWG) bonding jumpers across each cable tray splice or junction where splice plates cannot be used.
3. Bond cable tray installed in same room as telecommunications grounding busbar to busbar.

N. Communications Raceway Grounding:
1. Conduit: Use insulated 16 mm² (6 AWG) bonding jumpers to bond metallic conduit at both ends and intermediate metallic enclosures to ground.
2. Cable Tray Systems: Use insulated 16 mm² (6 AWG) grounding jumpers to bond cable tray to column-mounted building ground plates (pads) at both ends and approximately 16 meters (50 feet) on centers.

O. Ground Resistance:
1. Install telecommunications grounding system so resistance to grounding electrode system measures 5 ohms or less.
2. Measure grounding electrode system resistance using an earth test meter, clamp-on ground tester, or computer-based ground meter as defined in IEEE 81. Record ground resistance measurements before electrical distribution system is energized.
3. Backfill only after below-grade connection have been visually inspected by COR. Notify COR twenty-four hours before below-grade connections are ready for inspection.

P. Ground Rod Installation:
1. Drive each rod vertically in earth minimum 3000 mm (10 feet) in depth.
2. Make connections by exothermic process to form solid metal joints, where permanently concealed ground connections are required. Make accessible ground connections with mechanical pressure type ground connectors.
3. Install angled ground rods or grounding electrodes in horizontal trenches to achieve specified resistance, where rock prevents driving of vertical ground rods.

3.2 FIELD QUALITY CONTROL

A. Perform tests per BICSI's Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.

B. Perform two-point bond test using trained installers qualified to use test equipment.

C. Conduct continuity test to verify that metallic pathways in telecommunications spaces are bonded to TGB or TMGB.

D. Conduct electrical continuity test to verify that TMGB is effectively bonded to grounding electrode conductor.

E. Visually inspect to verify that screened and shielded cables are bonded to TGB or TMGB.

F. Perform a resistance test to ensure patch panel, rack and cabinet bonding connection resistance measures less than 5 Ohms to TGB or TMGB.

- - - E N D - - -

SECTION 27 05 33
RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL
1.1 DESCRIPTION

A. This section specifies conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for communications cabling unless shown or specified otherwise.

1.2 RELATED WORK

A. Sealing around penetrations to maintain integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.

B. Sealing around conduit penetrations through building envelope to prevent moisture migration into building: Section 07 92 00, JOINT SEALANTS.

C. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.

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.

1.3 SUBMITTALS

A. In accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, submit the following:

1. Size and location of cabinets, splice boxes and pull boxes.
2. Layout of required conduit penetrations through structural elements.
3. Catalog cuts marked with specific item proposed and area of application identified.

B. Certification: Provide letter prior to final inspection, certifying material is in accordance with construction documents and properly installed.

PART 2 - PRODUCTS
2.1 MATERIAL

A. Minimum Conduit Size: 19 mm (3/4 inch).

B. Conduit:

1. Rigid Galvanized Steel: Conform to UL 6, ANSI C80.1.
2. Rigid Aluminum: Conform to UL 6A, ANSI C80.5.
3. Rigid Intermediate Steel Conduit (IMC): Conform to UL 1242, ANSI C80.6.
4. Electrical Metallic Tubing (EMT):
   a. Maximum Size: 105 mm (4 inches).

b. Install only for cable rated 600 volts or less.

c. Conform to UL 797, ANSI C80.3.

5. Flexible Galvanized Steel Conduit: Conform to UL 1.
6. Liquid-tight Flexible Metal Conduit: Conform to UL 360.
7. Wireway, Approved “Basket”: Provide "Telecommunications Service” rated with approved length way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.

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: Are prohibited.
   g. Provide OEM approved fittings.
2. Electrical Metallic Tubing Fittings:
   a. Conform to UL 514B and ANSI/ NEMA FB1; only steel or malleable iron materials are acceptable.
   b. Couplings and Connectors: Concrete tight and rain tight, with connectors having insulated throats.
      1) Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller.
      2) Set screw fittings are prohibited.

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.

3. Flexible Steel Conduit Fittings:

a. Conform to UL 514B; only steel or malleable iron materials are acceptable.

b. Provide clamp type, with insulated throat.

c. Provide OEM approved fittings.

4. Liquid-tight Flexible Metal Conduit Fittings:

a. Conform to UL 514B and ANSI/ NEMA FB1; only steel or malleable iron materials are acceptable.

b. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening.

c. Provide connectors with insulated throats to prevent damage to cable jacket.

d. Provide OEM approved fittings.

5. 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.

6. Wireway Fittings: As recommended by wireway OEM.

D. Conduit Supports:

1. Parts and Hardware: Provide zinc-coat or equivalent corrosion protection.

2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

3. Multiple Conduit (Trapeze) Hangers: Minimum 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 2.78 mm (12 gage) steel, cold formed, lipped channels; with minimum 9 mm (3/8 inch) diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Splice, and Pull Boxes:
1. Conform to UL-50 and UL-514A.
2. Cast metal where required by NEC or shown, and equipped with rustproof boxes.
3. Sheet Metal Boxes: Galvanized steel, except where otherwise shown.
4. Install flush mounted wall or ceiling boxes with raised covers so that front face of raised cover is flush with wall.
5. Install surface mounted wall or ceiling boxes with surface style flat or raised covers.

F. Wireways: Equip with hinged covers, except where removable covers are shown.

G. 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”.

H. Flexible Nonmetallic Communications Raceway (Innerduct) and Fittings:
1. General: Provide UL 910 listed plenum, riser, and general purpose corrugated pliable communications raceway for optical fiber cables and communications cable applications; select in accordance with provisions of NEC Articles 770 and 800.
2. Provide Communications Raceway with a factory installed 567 kg (1250 lb.) tensile pre-lubricated pull tape.
3. Use only metallic straps, hangers and fittings to support raceway from building structure. Cable ties are not permitted for securing raceway to building structure.
4. Provide fittings to be installed in spaces used for environmental air made of materials that do not exceed flammability, smoke generation, ignitibility, and toxicity requirements of environmental air space.
5. Size: Metric Designator 53 (trade size 2) or smaller.
6. Outside Plant: Plenum-rated where each interduct is 75 mm (3 inches) and larger.

7. Inside Plant: Listed and marked for installation in plenum airspaces and minimum 25 mm (1 inch) inside diameter.
8. Plenum: Non-metallic communications raceway.
   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; one piece runs from ENTR to MH; MH to MH; DEMARC to MCR/TER; TR to TR. Innerduct connectors are not permitted between rooms.
10. Provide pulling accessories used for innerduct including but not limited to, inner duct lubricants, spreaders, applicators, grips, swivels, harnesses, and line missiles (blown air) compatible with materials being pulled.

I. Outlet Boxes:
   1. Flush wall mounted minimum 11.9 cm (4-11/16 inches) square, 9.2 cm (3-5/8 inches) deep pressed galvanized steel.
   2. 2-Gang Tile Box:
      a. Flush backbox type for installation in block walls.
      b. Minimum 92 mm (3-5/8 inches) deep.

J. Weatherproof Outlet Boxes: Surface mount two gang, 67 mm (2-5/8 inches) deep weatherproof cast aluminum with powder coated finish internal threads on hubs 19 mm (3/4 inch) minimum.

K. Cable Duct: Equip with hinged covers, except where removable covers are accepted by COR.

L. Cable Duct Fittings: As recommended by cable duct OEM.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Raceways typically required for cabling systems unless otherwise indicated:

System	Specification Section	Installed Method
Grounding	27 05 26	Conduit Not Required
Control, Communication and Signal Wiring	27 10 00	Complete Conduit Allowed in Non-Partitioned Cable Tray or Cable Ladders

B. Penetrations:

1. Cutting or Holes:

a. Locate holes in advance of installation. Where they are proposed in structural sections, obtain approval of structural engineer and COR prior to drilling through structural sections.

b. Make holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not permitted; COR may grant limited permission by request, in condition of limited working space.

c. Fire Stop: Where conduits, wireways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.

1) Fill and seal clearances between raceways and openings with fire stop material.

2) Install only retrofittable, non-hardening, and reusable firestop material that can be removed and reinstalled to seal around cables inside conduits.

d. Waterproofing at Floor, Exterior Wall, and Roof Conduit Penetrations:

1) Seal clearances around conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS or directed by waterproofing manufacturer.

C. Conduit Installation:

1. Minimum conduit size of 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). 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 closet 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 with a standard non-hardening putty compound to prevent entrance of moisture and gases and to meet fire resistance requirements.
8. 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)

9. Provide 19 mm (3/4 inch) thick fire retardant plywood on wall of communication closets where shown on drawings. Mount plywood with bottom edge 300 mm (12 inches) above finished floor and top edge 2.74 m (9 feet) A.F.F.
10. Provide pull wire in all empty conduits; sleeves through floor are exceptions.
11. Complete each entire conduit run installation before pulling in cables.
12. Flattened, dented, or deformed conduit is not permitted.
13. Ensure conduit installation does not encroach into ceiling height head room, walkways, or doorways.
14. Cut conduit square with a hacksaw, ream, remove burrs, and draw tight.
15. Install conduit mechanically continuous.
16. Independently support conduit at 2.44 m (8 feet) on center; do not use other supports (i.e., suspended ceilings, suspended ceiling

supporting members, luminaires, conduits, mechanical piping, or mechanical ducts).

17. Support conduit within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
18. Close ends of empty conduit with plugs or caps to prevent entry of debris, until cables are pulled in.
19. 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.
20. Do not use aluminum conduits in wet locations.
21. Unless otherwise indicated on drawings or specified herein, conceal conduits within finished walls, floors and ceilings.
22. 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.
23. Layout and Homeruns - Deviations: Make only where necessary to avoid interferences and only after drawings showing proposed deviations have been submitted and approved by COR.

D. Concealed Work Installation:

1. In Concrete:
    a. Conduit: Rigid steel.
    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.

Make couplings and connections watertight. Use thread compounds that are NRTL listed conductive type to ensure low resistance ground continuity through conduits.

E. Furred or Suspended Ceilings and in Walls:
1. Rigid steel,. Different type conduits mixed indiscriminately in same system is not permitted.
2. Align and run conduit parallel or perpendicular to building lines.

F. Exposed Work Installation:
1. Unless otherwise indicated on drawings, exposed conduit is only permitted in telecommunications rooms.
a. Provide rigid steel.
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.

G. Expansion Joints:
1. Conduits 75 mm (3 inches) and larger, that are secured to building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install couplings in accordance with manufacturer's recommendations.
2. Provide conduits smaller than 75 mm (3 inches) with pull boxes on both sides of expansion joint. Connect conduits to expansion and deflection couplings as specified.

3. Install expansion and deflection couplings where shown.

H. Seismic Areas:

1. In seismic areas, follow H-18-8 Seismic Design Requirements.
2. Rigidly secure conduit to building structure on opposite sides of a building expansion joint with pull boxes on both sides of joint.
3. Connect conduits to pull boxes with 375 mm (15 inches) of slack flexible conduit.
4. Install green copper wire minimum #6 AWG in flexible conduit for bonding jumper.

I. Conduit Supports, Installation:

1. Select AC193 code listed mechanical anchors or fastening devices with safe working load not to exceed 1/4 of proof test load.
2. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
3. Support multiple conduit runs with trapeze hangers. Use trapeze hangers designed to support a load equal or greater than sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other accepted fasteners.
4. Support conduit independent of pull boxes, luminaires, suspended ceiling components, angle supports, duct work, and similar items.
5. Fastenings and Supports in Solid Masonry and Concrete:
   a. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing concrete.
   b. Existing Construction:
      1) Code AC193 listed wedge type steel expansion anchors minimum 6 mm (1/4 inch) bolt size and minimum 28 mm (1-1/8 inch) embedment.
      2) Power set fasteners minimum 6 mm (1/4 inch) diameter with depth of penetration minimum 75 mm (3 inches).
      3) Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
6. Fastening to Hollow Masonry: Toggle bolts are permitted.
7. Fastening to Metal Structures: Use machine screw fasteners or other devices designed and accepted for application.

8. Bolts supported only by plaster or gypsum wallboard are not acceptable.
9. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
10. Do not support conduit from chain, wire, or perforated strap.
11. Spring steel type supports or fasteners are not permitted except horizontal and vertical supports/fasteners within walls.
12. Vertical Supports:
    a. Install riser clamps and supports for vertical conduit runs in accordance with NEC.
    b. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

J. Box Installation:
1. Boxes for Concealed Conduits:
    a. Flush mounted.
    b. Provide raised covers for boxes to suit wall or ceiling, construction and finish.
2. In addition to boxes shown, install additional boxes where needed to prevent damage to cables during pulling.
3. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
4. Stencil or install phenolic nameplates on covers of boxes identified on riser diagrams; for example "SIG-FA JB No. 1".
5. Outlet boxes mounted back-to-back in same wall are not permitted. A minimum 600 mm (24 inches) center-to-center lateral spacing must be maintained between boxes.

K. Flexible Nonmetallic Communications Raceway (Innerduct), Installation:
1. Install supports from building structure for horizontal runs at intervals not to exceed 900 mm (3 feet) and at each end.
2. Install supports from building structure for vertical runs at intervals not to exceed 1.2 m (4 feet) and at each side of joints.
3. Install only in accessible spaces not subject to physical damage or corrosive influences.
4. Make bends manually to assure internal diameter of tubing is not effectively reduced.

5. Extend each segment of innerduct minimum 300 mm (12 inches) beyond end of service conduit tie or cable tray. Restrain innerduct ends with wall mount clamps and seal when cable is installed.

3.2 TESTING

A. Examine fittings and locknuts for secureness.

B. Test RMC and EMT systems for electrical continuity.

C. Perform simple continuity test after cable installation.

- - - E N D - - -

SECTION 27 08 00
COMMISSIONING OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL
1.1 DESCRIPTION

A. This section includes requirements for commissioning facility communications systems, related subsystems and related equipment. This Section supplements general requirements specified in Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

B. Complete list of equipment and systems to be commissioned is specified in Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and Specification 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

C. Commissioned Systems:

1. Commissioning of systems specified in Division 27 is part of project's construction process including documentation and proof of performance testing of these systems, as well as training of VA's Operation and Maintenance personnel in accordance with requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and Division 27, in cooperation with Government and Commissioning Agent.
2. The facility exterior closure systems commissioning includes communications systems listed in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS and 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

1.2 RELATED WORK

A. System tests: Section 01 00 00, GENERAL REQUIREMENTS.

B. Commissioning process requires review of selected submittals that pertain to systems to be commissioned: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

C. Construction phase commissioning process and procedures including roles and responsibilities of commissioning team members and user training: Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

1.3 COORDINATION

A. Commissioning Agent will provide a list of submittals that must be reviewed by Commissioning Agent simultaneously with engineering review; do not proceed with work of sections identified without engineering and Commissioning Agent's review completed.

B. Commissioning of communications systems require inspection of individual elements of communications system construction throughout construction period. Coordinate with Commissioning Agent in accordance

with Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and commissioning plan to schedule communications systems inspections as required to support the commissioning process.

1.4 CLOSEOUT SUBMITTALS

A. Refer to Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for pre-functional checklists, equipment startup reports, and other commissioning documents.

B. Pre-Functional Checklists:

1. Complete pre-functional checklists provided by commissioning agent to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing.
2. Submit completed checklists to COR and to Commissioning Agent. Commissioning Agent can spot check a sample of completed checklists. If Commissioning Agent determines that information provided on the checklist is not accurate, Commissioning Agent then returns the marked-up checklist to Contractor for correction and resubmission.
3. If Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, Commissioning Agent can select a broader sample of checklists for review.
4. If Commissioning Agent determines that a significant number of broader sample of checklists is also inaccurate, all checklists for the type of equipment will be returned to Contractor for correction and resubmission.

C. Submit training agendas and trainer resumes in accordance with requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Contractor's Tests:

1. Scheduled tests required by other sections of Division 27 must be documented in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
2. Incorporate all testing into project schedule. Provide minimum seven calendar days' notice of testing for Commissioning Agent to witness selected Contractor tests at sole discretion of Commissioning Agent.

3. Complete tests prior to scheduling Systems Functional Performance Testing.

B. Systems Functional Performance Testing:

1. Commissioning process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions.
2. Commissioning Agent prepares detailed Systems Functional Performance Test procedures for review and acceptance by COR.
3. Provide required labor, materials, and test equipment identified in test procedure to perform tests.
4. Commissioning Agent must witness and document the testing.
   a. Provide test reports to Commissioning Agent. Commissioning Agent will sign test reports to verify tests were performed.

3.2 TRAINING

A. Training of Government's operation and maintenance personnel is required in cooperation with COR and Commissioning Agent.

B. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning location, operation, and troubleshooting of installed systems.

C. Schedule instruction in coordination with COR after submission and approval of formal training plans.

- - - E N D - - -

SECTION 27 10 00
CONTROL, COMMUNICATION AND SIGNAL WIRING

PART 1 - GENERAL
1.1 DESCRIPTION

A. This section includes control, communication and signal wiring for a comprehensive systems infrastructure.

B. This section applies to all sections of Divisions 27.

1.2 RELATED WORK

A. Sealing around penetrations to maintain integrity of time rated construction: Section 07 84 00, FIRESTOPPING.

B. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

C. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

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.

1.3 SUBMITTALS

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. Submit written certification from OEM:

1. Indicate wiring and connection diagrams meet National and Government Life Safety Guidelines, NFPA, NEC, NRTL, Joint Commission, OEM, this section and Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
2. Include instructions, requirements, recommendations, and guidance for proper performance of system as described herein.
3. Government will not approve any submittal without this certification.

C. Identify environmental specifications on technical submittals; identify requirements for installation.

1. Minimum floor space and ceiling heights.
2. Minimum size of doors for cable reel passage.

D. Power: Provide specific voltage, amperage, phases, and quantities of circuits.

E. Provide conduit size requirements.

F. Closeout Submittals:

1. Provide contact information for maintenance personnel to contact contractor for emergency maintenance and logistic assistance, and assistance in resolving technical problems at any time during warranty period.
2. Provide certified OEM sweep test tags from each cable reel to COR.
3. Furnish spare or unused wire and cable with appropriate connectors (female types) for installation in appropriate punch blocks, barrier strips, patch, or bulkhead connector panels.
4. Turn over unused and opened installation kit boxes, coaxial, fiber optic, and twisted pair cable reels, conduit, cable tray, cable duct bundles, wire rolls, physical installation hardware to COR.
5. Documentation: Include any item or quantity of items, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide system documentation required herein.

PART 2 - PRODUCTS

2.1 CONTROL WIRING

A. Provide control wiring large enough so voltage drop under in-rush conditions does not adversely affect operation of controls.

B. Provide cable meeting specifications for type of cable.

C. Outside Location (i.e. above ground, underground in conduit, ducts, pathways, etc.): Provide cables filled with a waterproofing compound between outside jacket (not touching any provided armor) and inter conductors to seal punctures in jacket and protect conductors from moisture.

D. Remote Control Cable:

1. Multi-conductor with stranded conductors able to handle power and voltage required to control specified system equipment, from a remote location.
2. NRTL listed and pass VW-1 vertical wire flame test (UL 83) (formerly FR-1).
3. Color-coded Conductors: Combined multi-conductor and coaxial cables are acceptable for this installation, on condition system performance standards are met.
4. Technical Characteristics:
   a. Length: As required, in 1K (3,000 ft.) reels minimum.
   b. Connectors: As required by system design.

c. Size:

1) 18 AWG, minimum, Outside.

2) 20 AWG, minimum, Inside.

d. Color Coding: Required, EIA industry standard.

e. Bend Radius: 10 times cable outside diameter.

f. Impedance: As required.

g. Shield Coverage: As required by OEM specification.

h. Attenuation:

Frequency in MHz	dB per 305 Meter (1,000 feet), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0
50.0	52.0

E. Distribution System Signal Wires and Cables:

1. Provide in same manner, and use construction practices, as Fire Protective and other Emergency Systems identified and defined in NFPA 101, Life Safety Code, Chapters 7, 12, and 13, NFPA 70, National Electrical Code, Chapter 7, Special Conditions.
2. Provide system able to withstand adverse environmental conditions without deterioration, in their respective location.
3. Provide entering of each equipment enclosure, console, cabinet or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of cables.
4. Terminate on an item of equipment by direct connection.

2.2 COMMUNICATION AND SIGNAL WIRING

A. Provide communications and signal wiring conforming to recommendations of manufacturers of systems ; provide not less than TIA Performance Category 6.

B. Wiring shown is for typical systems; provide wiring as required for systems being provided.

C. Provide color-coded conductor insulation for multi-conductor cables.

D. Connectors:
   1. Provide connectors for transmission lines, and signal extensions to maintain uninterupted continuity, ensure effective connection, and preserve uniform polarity between all points in system.
      a. Provide AC barrier strips with a protective cover to prevent accidental contact with wires carrying live AC current.
      b. Provide punch blocks for signal connection, not AC power. AC power twist-on wire connectors are not permitted for signal wire terminations.
   2. Cables: Provide connectors designed for specific size cable and conductors being installed with OEM's approved installation tool. Typical system cable connectors include:
      a. Audio spade lug.
      b. Punch block.
      c. Wirewrap.

2.3 INSTALLATION KIT

A. Include connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, cable tray, etc., required to accomplish a neat and secure installation.

B. Terminate conductors in a spade lug and barrier strip, wire wrap terminal or punch block, so there are no unfinished or unlabeled wire connections.

C. Minimum required installation sub-kits:
   1. System Grounding:
      a. Provide required cable and installation hardware for effective ground path, including the following:
         1) Control Cable Shields.
         2) Data Cable Shields.
         3) Equipment Racks.
         4) Equipment Cabinets.
         5) Conduits.
         6) Ducts.
         7) Cable Trays.
         8) Power Panels.
         9) Connector Panels.

10) Grounding Blocks.

b. Bond radio equipment to earth ground via internal building wiring, according to NEC.

2. Wire and Cable: Provide connectors and terminals, punch blocks, tie wraps, hangers, clamps, labels, etc. required to accomplish termination in an orderly installation.
3. Conduit, Cable Duct, and Cable Tray: Provide conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, cable tray installation in accordance with NEC and documents.
4. Equipment Interface: Provide any items or quantity of equipment, cable, mounting hardware and materials to interface systems with identified sub-systems, according to OEM requirements and construction documents.
5. Labels: Provide any item or quantity of labels, tools, stencils, and materials to label each subsystem according to OEM requirements, as-installed drawings, and construction documents.

D. Cross-Connection System (CCS) Equipment Breakout, Termination Connector (or Bulkhead), and Patch Panels:

1. Connector Panels: Flat smooth 3.175 mm (1/8 inch) thick solid aluminum, custom designed, fitted and installed in cabinet. Install bulkhead equipment connectors on panel to enable cabinet equipment’s signal, control, and coaxial cables to be connected through panel. Match panel color to cabinet installed.
   a. Voice (or Telephone):
      1) Provide industry standard Type 110 (minimum) punch blocks for voice or telephone, and control wiring instead of patch panels, each being certified for category 6.
      2) IDC punch blocks (with internal RJ45 jacks) are acceptable for use in CCS when designed for Category 6 and the size and type of cable used.
      3) Secure punch block strips to OEM designed physical anchoring unit on a wall location in TRS; console, cabinet, rail, panel, etc. mounting is permitted at OEM recommendation and as accepted by COR. Punch blocks are not permitted for Class II or 120 VAC power wiring.

4) Technical Characteristics:
   a) Number of Horizontal Rows: Minimum 100.
   b) Number of Terminals per Row: Minimum 4.
   c) Terminal Protector: Required for each used or unused terminal.
   d) Insulation Splicing: Required between each row of terminals.

b. Digital or High Speed Data:
   1) Provide 480 mm (19 inches) horizontal EIA/ECA 310 rack mountable patch panel with EIA/ECA 310 standard spaced vertical mounting holes for digital or high-speed data service CSS, with modular female Category 5E (or on a case by case basis Category 6/6A as required by the manufacturer for specialized powered systems accepted by SMCS 005OP2H3, (202) 461-5310, OI&T and FMS Services, and COR) RJ45 jacks designed for size and type of UTP or F/UTP cable installed in rows.
   2) Technical Characteristics:
      a) Number of Horizontal Rows: Minimum 2.
      b) Number of Jacks Per Row: Minimum 24.
      c) Type of Jacks: RJ45.
      d) Terminal Protector: Required for each used or unused jack.
      e) Insulation: Required between each row of jacks.

2.4 EXISTING WIRING

A. Reuse existing wiring only where indicated on plans and accepted by SMCS 005OP2H3.

B. Only existing wiring that conforms to specifications and applicable codes can be reused; existing wiring that does not meet these requirements cannot be reused and must be removed by contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install wiring in cable tray or raceway.
   2. Seal cable entering a building from underground, between wire and conduit where cable exits conduit, with non-hardening approved compound.
   3. Wire Pulling:
      a. Provide installation equipment that prevents cutting or abrasion of insulation during pulling of cables.

b. Use ropes made of nonmetallic material for pulling feeders.

c. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached to conductors, as accepted by COR.

d. Pull multiple cables into a single conduit together.

B. Installation in Maintenance or Man holes:

1. Install and support cables in maintenance holes on steel racks with porcelain or equal insulators.

2. Train cables around maintenance hole walls, but do not bend to a radius less than six times overall cable diameter.

3. Fireproofing:

a. Install fireproofing where low voltage cables are installed in same maintenance holes with high voltage cables; also cover low voltage cables with arc proof and fireproof tape.

b. Use tape of same type used for high voltage cables, and apply tape in a single layer, one-half lapped or as recommended by manufacturer. Install tape with coated side towards the cable and extend minimum 25 mm (1 inch) into each duct.

c. Secure tape in place by a random wrap of glass cloth tape.

C. Control, Communication and Signal Wiring Installation:

1. Unless otherwise specified in other sections, provide wiring and connect to equipment/devices to perform required functions as indicated.

2. Install separate cables for each system so that malfunctions in any system does not affect other systems, except where otherwise required.

3. Group wires and cables according to service (i.e. AC, grounds, signal, DC, control, etc.); DC, control and signal cables can be included with any group.

4. Form wires and cables to not change position in group throughout the conduit run. Bundle wires and cables in accepted signal duct, conduit, cable ducts, or cable trays neatly formed, tied off in 600 mm to 900 mm (24 inch to 36 inch) lengths to not change position in group throughout run.

5. Concealed splices are not allowed.

6. Separate, organize, bundle, and route wires or cables to restrict EMI, channel crosstalk, or feedback oscillation inside any enclosure.

7. Looking at any enclosure from the rear (wall mounted enclosures, junction, pull or interface boxes from the front), locate AC power, DC and speaker wires or cables on the left; coaxial, control, microphone and line level audio and data wires or cables, on the right.
8. Provide ties and fasteners that do not damage or distort wires or cables. Limit spacing between tied points to maximum 150 mm (6 inches).
9. Install wires or cables outside of buildings in conduit, secured to solid building structures.
10. Wires or cables must be specifically accepted, on a case by case basis, to be installed outside of conduit. Bundled wires or cables must be tied at minimum 460 mm (18 inches) intervals to a solid building structure; bundled wires or cables must have ultra violet protection and be waterproof (including all connections).
11. Laying wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors, etc. is not permitted.
12. Wires or cables installed outside of conduit, cable trays, wireways, cable duct, etc.:
    a. Only when authorized, can wires or cables be identified and approved to be installed outside of conduit.
    b. Provide wire or cable rated plenum and OEM certified for use in air plenums.
    c. Provide wires and cables hidden, protected, fastened and tied at maximum 600 mm (24 inches) intervals, to building structure.
    d. Provide closer wire or cable fastening intervals to prevent sagging, maintain clearance above suspended ceilings.
    e. Remove unsightly wiring and cabling from view, and discourage tampering and vandalism.
    f. Sleeve and seal wire or cable runs, not installed in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers, with an approved fire retardant sealant.

D. AC Power:
1. Bond to ground contractor-installed equipment and identified Government-furnished equipment, to eliminate shock hazards and to minimize ground loops, common mode returns, noise pickup, crosstalk, etc. for total ground resistance of 0.1 Ohm or less.

2. Use of conduit, signal duct or cable trays as system or electrical ground is not permitted; use these items only for dissipation of internally generated static charges (not to be confused with externally generated lightning) that can be applied or generated outside mechanical and physical confines of system to earth ground. Discovery of improper system grounding is grounds to declare system unacceptable and termination of all system acceptance testing.
3. Cabinet Bus: Extend a common ground bus of at least #10 AWG solid copper wire throughout each equipment cabinet and bond to system ground. Provide a separate isolated ground connection from each equipment cabinet ground bus to system ground. Do not tie equipment ground busses together.
4. Equipment: Bond equipment to cabinet bus with copper braid equivalent to at least #12 AWG. Self-grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternatives.

3.2 EQUIPMENT IDENTIFICATION

A. Control, Communication and Signal System Identification:
1. Install a permanent wire marker on each wire at each termination.
2. Identify cables with numbers and letters on the labels corresponding to those on wiring diagrams used for installing systems.
3. Install labels retaining their markings after cleaning.
4. In each maintenance hole (manhole) and handhole, install embossed brass tags to identify system served and function.

B. Labeling:
1. Industry Standard: ANSI/TIA-606-B.
2. Print lettering for voice and data circuits using laser printers handwritten labels are not acceptable.
3. Cable and Wires (hereinafter referred to as “cable”): Label cables at both ends in accordance with industry standard. Provide permanent labels in contrasting colors. Identify cables matching system Record Wiring Diagrams.
4. Equipment: Permanently labeled system equipment with contrasting plastic laminate or bakelite material. Label system equipment on face of unit corresponding to its source.

5. Conduit, Cable Duct, and Cable Tray: Label conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying system. Label each enclosure according to this standard.
6. Termination Hardware: Label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with industry standard and Record Wiring Diagrams.

3.3 TESTING

A. Minimum test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on cables in frequency ranges specified.
B. Tests required for data cable must be made to confirm operation of this cable at minimum 10 Mega (M) Hertz (Hz) full bandwidth, fully channel loaded and a Bit Error Rate of a minimum of 10-6 at maximum rate of speed.
C. Provide cable installation and test records at acceptance testing to COR and thereafter maintain in facility’s telephone switch room.
D. Record changes (used pair, failed pair, etc.) in these records as change occurs.
E. Test cables after installation and replace any defective cables.

- - - E N D - - -

SECTION 27 11 00
TELECOMMUNICATIONS ROOM FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies equipment cabinets, interface enclosures, relay racks, and associated hardware in service provider DEMARC, computer and telecommunications rooms.

B. Telephone system is defined as an Emergency Critical Care Communication System by the National Fire Protection Association (NFPA). Adhere to Seismic reference standards for systems connecting to or extending telephone system and cabling.

1.2 RELATED WORK

A. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. 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.

C. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

D. Low voltage cabling system infrastructure: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.

1.3 SUBMITTALS

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATION.

B. Separate submittal into sections for each subsystem containing the following:

1. Pictorial layouts of each Telecommunications Room and Cross Connection Space (VCCS, and HCCS termination cabinets), each distribution cabinet layout, and TCO as each is expected to be installed and configured.
2. Equipment technical literature detailing electrical and technical characteristics of each item of equipment to be furnished.

C. Environmental Requirements: Identify environmental specifications for housing system as initial and expanded system configurations.

1. Floor loading for batteries and cabinets.
2. Minimum floor space and ceiling height.
3. Minimum door size for equipment passage.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide components of cabinet system (cabinet, thermal, cable and power management accessories) from a single manufacturer.

B. Equipment Standards and Testing:

1. Equipment must be listed by a NRTL where a UL standard is in existence; active and passive equipment must conform with each UL standard in effect for equipment, on the submittal date.
2. Each item of electronic equipment must be labeled by a NRTL that warrants equipment has been tested in accordance with, and conforms to specified standards.

C. Equipment Cabinets (Enclosures):

1. Fully enclose and physically secure internally mounted and connected, active and passive equipment.
2. Types of Equipment Enclosures accepted for specific VA Spectrum Management, FMS and OI&T applications in CFM and Facility Projects:

CABINET	FUNCTION
Communications	FMS Special Communications Equipment
Server / Router	OI&T Data/LAN/WAN Equipment
Seismic	Either FMS or OI&T use, specify need
Environmental	Either FMS or OI&T use, specify need

3. Each cabinet to be:
   a. Fabricated with minimum 1.59 mm (16 gauge) steel.
   b. Provided with manufacturer's standard painted finish in a color accepted by COR with concurrence from FMS Service Chief.
   c. Mounted on wall.
   d. Lockable; tubular locks keyed alike. Provide six keys to COR for each cabinet.
4. Provide equipment mounting shelves; attach to front and rear mounting rails and allowing equipment to be secured to respective mounting rails.
5. Each enclosure to include:
   a. Wall mounting.
   b. Knock out holes for conduit connections or cable entrance.
   c. Front and rear locking doors; wall mounted cabinets require only front locking door.
   d. Power outlet strips.

6. Provide quiet ventilation fan with non-disposable locally cleanable air filter.
7. Size each cabinet in order to contain and maintain internal mounted equipment items.
8. Provide OEM's fully assembled unit.
9. Provide OEM assembled side-by-side enclosures in a single unit, at locations requiring more than two enclosures.
10. Provide minimum one cabinet with blank rack space, for additional system expansion equipment.
11. Bond to communications circulating grounding system.
12. Cabinet Internal Components:
    a. AC Power:
        1) Standard "Quad AC Box":
            a) Power capacity: 20 Ampere, single phase, 120 VAC continuous duty.
            b) Wire gauge: #12 AWG, solid copper, connected to room's internal AC Power Panel, or as directed by COR.
            c) Number of AC power outlets: Minimum 4 receptacles.
            d) Enclosure: Fully self-contained, metal 102 mm (4 inch) x 102 mm (4 inches) x 64 mm (2-1/2 inches) with cover
            e) Connection: Minimum 25.4 mm (1 inch) conduit connected to room's AC Power Panel, or as directed by COR
            f) Number of boxes: One.
            g) Compliance: NRTL (i.e. UL); NPFA - 70 (NEC).
    b. AC Power Line Surge Protector and Filter Construction:
        1) Input Voltage Range: 120 VAC + 15 percent at 50/60 Hz, single phase.
        2) Power Service Capacity: 20 AMP, 120 VAC.
        3) Voltage Output Regulation: +5.0 percent, instantaneous of input.
        4) Circuit Breaker: 15 AMP; may be self-contained.
        5) AC Outlets: Minimum four duplex grounded NEMA 5-20R.
        6) Response Time: 5.0 nanosecond.
        7) Suppression: Isolate and filter any noise, surge spikes
            a) Surge: Minimum 20,000 AMP.
            b) Noise:
                1) Common: -40 dB.

2) Differential: -45 dB.

8) Clamping Voltage: Minimum 300 V.

9) Enclosure: One; self-contained.

10) Mounting: Internal to cabinet floor or on internal mounting rail shelf, allowing two plugs from two plug strips.

11) AC Power Cord: Required; minimum 1,628 mm (6 feet), three wire (green ground); minimum #14 AWG stranded.

12) Compliance: NRTL (i.e. UL60950-1).

13. Ground Interconnection: Bond cabinet's common grounding lug to room's communications circulating ground busbar with a minimum #4 AWG stranded copper wire.

D. Environmental Cabinet:

1. Enclosure must fully contain installed equipment, including electronics, in same manner as standard cabinet. Provide climate control for installed equipment as if they were in a standalone air handling area, regardless of local area air handling capabilities.
2. Provide an OEM's fully assembled unit enclosure.
3. If more than two enclosures are required in any system location, provide OEM-assembled enclosures, in a single unit, side-by-side.
4. Technical Characteristics:
   a. Environmental Control: Automatic, heating and cooling as required.
   b. Temperature Conditions (rated at 1,300 W of install equipment heat generation):
      1) Internal Range: Maintains 26.67 degree to 37.78 degree C (80 degree to 100 degree f) of internal heat conditions.
      2) External Range: Maximum 37.78 degrees + -3.89 degrees C (100 degrees + 25 degrees F).
   c. Heater: As required; fully internal mounted.
   d. Front Door: Full length, see through, EMI resistant and lockable, keyed alike with 7-pin tubular lock.
   e. Rear door: Full length, see through, EMI resistant, and lockable keyed alike with 7-pin tubular lock.
   f. Conduit Wiring Entrance: Top or bottom; fully sealed.
   g. Input Power: Minimum 2 each; maximum 120 VAC at 20A, independent circuit, conduit for fixed or armored cable for moveable installations.

h. Dimensions:
1) Height: Maximum 1980 mm (78 inches).
2) Width: Maximum 635 mm (25 inches).
3) Depth: Maximum 965 mm (38 inches).
4) Front Panel Opening: 480 mm (19 inches), w/ EIA/ECA 310 mounting hole spacing.

E. Wall Mounted Distribution or System Interface Cabinet:
1. Construct of minimum 1.59 mm (16 gauge) cold rolled steel, with top, side and bottom panels.
2. Provide double-hinged front door and main cabinet body allowing access to all internal equipment and wiring; mount to solid walls or internal studs.
3. Provide baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using FMS Chief or COR.
4. Provide integral and adjustable EIA/ECA 310 standard predrilled rack mounting rails to allow front panel equipment mounting and access.
5. After equipment, doors and panels are installed, snap-in-place chrome trim strip covers all front panel screw fasteners.
6. Provide full-length vertical piano hinge to allow entire front portion of cabinet to “swing out” from wall for access to installed equipment, wires and cable; maintain minimum OSHA Safety clearances and NFPA operational functions.
7. Provide an OEM’s fully assembled unit enclosure.
8. Equip these cabinets same as equipment cabinets, except mount UPS on floor below cabinet with AC power connection in conduit to AC service panel.
9. Technical Characteristics:
a. Overall Height: Maximum 1,218 mm (48 inches).
b. Overall Depth: Maximum 558 mm (22 inches).
c. Overall Width: Maximum 610 mm (24 inches).
d. Front Panel Horizontal: Maximum width 483 mm (19 inches).
e. Capacity: Maximum 180 kilograms (400 pounds).
f. Lockable:
1) Tubular lock with 7-pin security.
2) Key cabinets alike.

F. Wire Management Equipment:
   1. Provide an orderly horizontal and vertical interface between outside and inside wires and cables, distribution and interface wires and cables, interconnection wires and cables and associated equipment, jumper cables, and provide an uniform connection media for system fire-retardant wires and cables and other subsystems.
   2. Interface to each cable tray, duct, wireway, or conduit used in the system.
   3. Interconnection or distribution wires and cables must enter system at top (or from a wireway in the floor) via overhead protection system and be uniformly routed down either or both sides at same time, of the frames side protection system, then laterally for termination on rear of each respective terminating assembly.
   4. Custom configure to meet 30 percent fill system design and user needs.

G. Vertical Cable Managers:
   1. Use same make, style and size of vertical cable manager on rack/frame or in between racks/frames when more than one cable manager is used on a rack/frame or group of racks/frames.
   2. Match color and cover style of racks/frames and cable managers.

H. Horizontal Cable Managers:
   1. Use same make and style of cable manager on rack/frame or racks/frames, when more than one horizontal cable manager is used on a rack/frame or group of racks/frames.
   2. Match color of racks/frames and cable managers.

I. Provide installation hardware when enclosures or racks are attached to structural floor.

J. Provide noise filters and surge protectors for each equipment interface cabinet, switch equipment cabinet, control console, and local and remote active equipment locations to ensure protection from input primary AC power surges so as a consequence noise glitches are not induced into low voltage data circuits.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate cabinet installation such that doors fully close and lock, with active and passive equipment installed and connected.

B. Verify equipment dimensions and brackets allow mounting with cabinet doors closed. Front door or rear door of any cabinet that does not

close and lock may result in immediate cancellation of inspections or tests.

3.2 INSTALLATION

A. Equipment Cabinets:

1. Install cabinets in a manner that complies with OEM instructions, requirements of this specification, and in a manner which does not constitute a safety hazard.
2. Provide weatherproof equipment installed outdoors or install in NEMA 3S rated enclosures with hinged doors and locks with two keys.
3. Install equipment indoors in NEMA 4 rated metal cabinets with hinged doors and locks with two keys.

B. Grounding:

1. Bond equipment, including identified Government furnished equipment, to ground so total ground resistance measures maximum 0.1 Ohm.
   a. Install lightning arrestors and grounding in accordance with NFPA.
   b. Install gas protection devices at nearest point of entrance in buildings where protection is required and on same circuits as MDF in telephone switch room.
   c. Do not use AC neutral, including in power panel or receptacle outlet, for system control, subcarrier or audio reference ground.
   d. Use of conduit, signal duct or cable trays as system or electrical ground is not permitted.
2. Connect each equipment grounding terminal to a separate mounting hole on equipment mounting rail, to right as one looks at it from rear, with a minimum #12 AWG stranded copper wire with protective green jacket.
3. Extend common ground bus of minimum #10 AWG solid copper wire throughout each equipment cabinet and bond to TGB. Provide a separate isolated ground connection from each equipment cabinet ground bus to system ground. Do not tie equipment ground buses together.
4. Bond equipment to cabinet bus with copper braid equivalent to #12 AWG. Self-grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternatives.

5. Bond cable shields to cabinet ground bus with minimum #12 AWG stranded copper wire at only one end of cable run. Insulate cable shields from each other, faceplates, equipment racks, consoles, enclosures or cabinets, except at system common ground point. Bond coaxial and audio cables only at source; in all cases, keep cable shield ground connections to a minimum.

C. Equipment Assembly:

1. Cabinets:

a. Install and adjust cabinet/frame accessories to position, including thermal management accessories, vertical cable managers, vertical power managers and equipment-mounting rails, using manufacturer’s installation instructions prior to baying or placing cabinet for attachment to building and before installing any rack-mount equipment into cabinet. Shelves, horizontal cable managers and filler panels (rack-mount accessories), if used, may be installed after cabinet is placed.

b. When used in a multi-cabinet bay, attach cabinets side-by-side using baying kits according to manufacturer’s instructions.

c. Attach overhead ladder rack or cable tray to ceiling or top of cabinet. Maintain minimum 75 mm (3 inches) clearance between top of cabinet and bottom of ladder rack/cable tray. Position ladder rack/cable tray so that it does not interfere with hot air exhaust through cabinet’s top panel. Use radius drops where cable enters or exits ladder rack/cable tray.

d. In seismic areas, install additional bracing as required by building codes and recommendations of a licensed structural engineer.

e. Attach bonding conductor sized per TIA-607-B between telecommunications grounding busbar and cabinet. Attach bonding conductor to cabinet using a ground terminal block according to manufacturer’s installation instructions.

f. Provide bonding conductor and other hardware required to make connections between cabinet and telecommunications grounding busbar.

g. Install rack mounted equipment normally requiring adjustment or observation so operational adjustments can be conveniently made.

h. Mount heavy equipment with rack slides or rails to allow servicing from front of enclosure. Provide support in addition to front panel mounting screws for heavy equipment.
i. Provide with cable slack to permit servicing by removal of installed equipment from front of enclosure.
j. Install color-matched blank panel spacer 44 mm (1.75 inches) high between each piece of active and passive equipment to ensure adequate air circulation for efficient equipment cooling and air ventilation.
k. Install enclosures and racks plumb and square, permanently attached to building structure and held in place.
l. Provide 381 mm (15 inches) of front vertical space opening for additional equipment.
m. Install equipment located indoors in metal racks or enclosures with hinged doors to allow access for maintenance without causing interference to other nearby equipment.
n. Cables must enter equipment racks or enclosures in such a manner to allow doors or access panels to open and close without disturbing or damaging cables.
o. Mount distribution hardware in a manner that allows access to connections for testing and provides room for doors or access panels to open and close without disturbing the cables.

2. Racks:
a. Assemble racks according to manufacturer’s instructions.
b. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching rack to floor.
c. Attach assembled racks to floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through raised floor tile and be secured in structural floor below.
d. Bond racks to telecommunications grounding busbar using appropriate hardware provided by contractor.
e. In seismic areas, install additional bracing as required by building codes and recommendations of a licensed structural engineer.

f. Ladder rack may be attached to top of rack to deliver cables to rack. Do not drill rack to attach; use appropriate hardware from rack manufacturer.
g. Provide radius drops to guide cable where cable exits or enters side of overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field.
h. Evenly distribute equipment load on rack. Place large and heavy equipment towards bottom of rack. Secure equipment to rack with equipment mounting screws. In seismic areas, secure equipment to shelves with additional bracing.

3. Vertical Cable Managers:
   a. Provide vertical managers so number of cables in each manager does not exceed OEM fill capacity.
   b. Attach vertical cable managers to side of rack/frame using manufacturer’s installation instructions and hardware.
   c. Attach vertical cable manager to both racks/frames when a single vertical cable manager is used between two racks/frames.
   d. Dress cables through openings in between T-shaped guides on manager so that cables make gradual bends as they exit or enter cable manager into rack-mount space (RMU). Do not twist, coil or make sharp bends in cables.
   e. Attach doors to cable manager in closed position after cabling is complete.
4. Horizontal Cable Managers:
   a. Attach horizontal cable managers to rack/frame with minimum four screws according to manufacturer’s installation instructions. Center each cable manager within allocated rack-mount space (RMU).
   b. Provide horizontal managers located so number of cables each manager supports is less than cable manager’s cable fill capacity.
   c. Dress cables through openings in between T-shaped guides on cable manager so that cables make gradual bends as they exit or enter cable manager into rack-mount space (RMU). Do not twist, coil or make sharp bends in cables.
   d. Attach covers to cable manager in closed position after cabling is complete.

D. Labeling: Permanently label each enclosure in accordance with TIA-606-B using laser printers / thermal ink transfer process; handwritten labels are not acceptable.

1. Equipment: Label system equipment with contrasting plastic laminate or bakelite material on face of unit corresponding to its source.
2. Conduit, Cable Duct, and/or Cable Tray: Label conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 m (10 feet), identifying system.

- - - E N D - - -

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 Medical Center, here-in-after referred to as the "facility".

1.2 RELATED WORK

A. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. 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.

C. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

D. 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 area of work showing termination cabinets, each distribution cabinet and rack, as each is expected to be installed and configured.
2. List of test equipment as per Section 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 6/6A requirements.

D. Provide continuous inter- and/or intra-facility voice, data, and analog service.

1. Provide voice and data cable distribution system based on a physical "Star" topology.
2. Provide separate cable distribution system for emergency, safety and protection systems (i.e. emergency bypass phones; police emergency voice communications from parking lots and stairwells personal protection, duress alarms and annunciation systems; etc.)
3. Contact SMCS 005OP2H3 (202-462-5310) for specific technical assistance and approvals.

E. Specific Subsystem Requirements: Provide products necessary for a complete and functional data 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. 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.

3. Fiber Optics Backbone Cable:

a. Provide cable as required by manufacturer to ensure a complete and operational system.

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 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 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 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. 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.

D. 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.

E. 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 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.

F. 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.

2.3 DISTRIBUTION EQUIPMENT AND SYSTEMS

A. Backbone Distribution Cables:
   1. Meet TIA transmission performance requirements of Voice Grade Category 6/6A.
   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. Maximum attenuation for 100m at 20° C:

Frequency (MHz)	Category 6 (dB)	Category 6A (dB)
.772	-	-
1	2.0	2.1
4	3.8	3.8
8	5.3	5.3
10	6.0	5.9
16	7.6	7.5
20	8.5	8.4
25	9.5	9.4
31.25	10.7	10.5
62.5	15.4	15.0
100	19.8	19.1
200	29.0	27.6
250	32.8	31.1
300		34.3
400		40.1
500		45.3

4. Data Multi-Conductor:

a. Unshielded cable with solid conductors.

b. Able to handle the power and voltage used over the distance required.

c. Meets TIA transmission performance requirements of Category 6/6A.

d. Technical Characteristics:

1) 0.205 mm2 (24 AWG) - 0.326 mm2 (22 AWG) cable

2) Bend Radius: 10 times cable outside diameter.

3) Impedance: 100 Ohms + 15%, BAL.

4) Bandwidth: 250 MHz / 500 MHz.

5) DC Resistance: Maximum 9.38 Ohms/100m (328 ft.) at 20 degrees C.

6) Maximum Mutual Capacitance: 5.6 nF per 100 m (328 ft.).

7) Shield Coverage:

a) Overall Outside (if OEM specified): 100 percent.

b) Individual Pairs (if OEM specified): 100 percent.

8) Maximum attenuation for 100m (328 ft.) at 20° C:

Frequency (MHz)	Category 6 (dB)	Category 6A (dB)
1	2.0	2.1
4	3.8	3.8
8	5.3	5.3
10	6.0	5.9
16	7.6	7.5
20	8.5	8.4
25	9.5	9.4
31.25	10.7	10.5
62.5	15.4	15.0
100	19.8	19.1
200	29.0	27.6
250	32.8	31.1
300		34.3
400		40.1
500		45.3

5. Fiber Optic:

a. Multimode Fiber:

1) Provide OM4 / OM2 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.

B. Outlet Connection Cables:

1. 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 5E or on a case-by-case basis Category 6 / 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.

2. 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 / SC male on each end.

4) Size: To fit OM1 single mode or OM4 multimode cable.

C. 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.

D. 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 / SC.

e. Construction: Ceramic.

E. Conduit and Signal Ducts:

1. Conduit:

a. Provide conduit or sleeves for cables penetrating walls, ceilings, floors, interstitial space, fire barriers, etc.

b. Minimum Conduit Size: 19 mm (3/4 inch).

c. Provide separate conduit and signal ducts for each cable type installation.

d. When metal (plastic covered, flexible cable protective armor, etc.) systems are authorized to be provided for use in system, follow installation guidelines and standard specified in Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS and NEC.

e. Maximum 40 percent conduit fill for cable installation.

2. Signal Duct, Cable Duct, or Cable Tray: Use existing signal duct, cable duct, and cable tray, when identified and accepted by COR.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install for ease of operation, maintenance, and testing.

B. Install system to comply with NFPA 70 National Electrical Code, NFPA 99 Health Care Facilities, NFPA 101 Life Safety Code, Joint Commission Manual for Health Care Facilities, and original equipment manufacturers' (OEM) installation instructions.

C. Cable Systems Installation:

1. Install system cables in cable duct, cable tray, cable runway, conduit or when specifically approved, flexible NEC Article 800 communications raceway. Confirm drawings show sufficient quantity and size of cable pathways. If flexible communications raceway is used, install in same manner as conduit.

2. Coordinate outside plant and backbone cables to furnish number of cable pairs for system requirements and obtain approval of COR and IT Service prior to installation.

3. Bond to ground metallic cable sheaths, etc. (i.e. risers, underground, horizontal, etc.).

4. Install temporary cable to not present a pedestrian safety hazard and be responsible for all work associated with removal. Temporary cable installations are not required to meet Industry Standards; but, must be reviewed and accepted by COR, IT Service, FMS and SMCS 005OP2H3 (202-461-5310) prior to installation.

D. Patient Bedside Prefabricated Units (PBPU) Installation:

1. Under no circumstances, proceed with installing PBPU without written approval of PBPU OEM and specific instructions regarding attachment to or modifying of PBPU.

2. Maintain UL integrity of each PBPU. If installation violates UL integrity, obtain on site UL re-certification of violated PBPU at the direction of COR.

E. Labeling:

1. Industry Standard: Provide labeling in accordance with ANSI/TIA-606-B.
2. Print lettering of labels with laser printers / thermal ink transfer process; 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 / T568A 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 of test time, with notification of the acceptance test.

E. Verification Tests:

1. Test UTP / STP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test cables after termination and prior to cross-connection.
2. Multi-mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with 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 5E (or on a case by case basis Category 6/6A 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/STP copper cabling systems and multi-mode/and single mode/fiber optic cabling systems after complete telecommunication distribution system and workstation outlet are installed.

3.3 MAINTENANCE

A. Accomplish the following minimum requirements during one year warranty period:

1. Respond and correct on-site trouble calls, during standard work week:
   a. A routine trouble call within one working day of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.

b. Standard work week is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal holidays.

2. Respond to an emergency trouble call within six hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at any time.
3. Respond on-site to a catastrophic trouble call within four hours of its report. A catastrophic trouble call is considered total system failure.
   a. If a system failure cannot be corrected within four hours (exclusive of standard work time limits), provide alternate equipment, or cables within four hours after four hour trouble shooting time.
   b. Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) are also be deemed as a catastrophic trouble.
4. Provide COR written report itemizing each deficiency found and the corrective action performed during each official reported trouble call. Provide COR with sample copies of reports for review and approval at beginning of total system acceptance test.

- - - E N D - - -