PROJECT MANUAL

REPLACE HOT WATER TANKS, BUILDINGS 1 & 2
MANN-GRANDSTAFF VA MEDICAL CENTER
4815 NORTH ASSEMBLY STREET
SPOKANE, WA 99205

VA PROJECT NUMBER: 668-16-101

OWNER
US DEPARTMENT OF VETERANS AFFAIRS
MANN-GRANDSTAFF VA MEDICAL CENTER
4815 NORTH ASSEMBLY STREET
SPOKANE, WA 99205

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WILLIAM WILSON ARCHITECTS, PC
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PORTLAND, OR 97205

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RIVERSIDE ENGINEERING, PLLC
816 W. FRANCIS AVENUE, #381
SPOKANE, WA 99205

ELECTRICAL ENGINEER
TRINDERA ENGINEERING
1875 N. LAKEWOOD DRIVE, SUITE 201
COEUR D'ALENE, ID 83814

100% Bidding and Construction Set
November 30, 2016
PROJECT

Replace Hot Water Tanks, Buildings 1 & 2
Mann-Grandstaff VA Medical Center
4815 North Assembly Street
Spokane, WA 99205

VA Project No. 668-16-101

OWNER

US Department of Veterans Affairs
Mann-Grandstaff VA Medical Center
4815 North Assembly Street
Spokane, WA 99205

Contracting Officer Representative (COR)

Jesse Hahne
Phone: (Office) (509)434-7448
(Mobile) (509)570-2212
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The drawings listed below accompanying this specification form a part of the contract.

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**MECHANICAL**
- M-001 LEGENDS AND ABBREVIATIONS
- M-101 MECHANICAL SCHEDULES
- DP-101 HOT WATER TANKS – HOSPITAL – DEMO
- DP-201 HOT WATER TANKS – LAUNDRY – DEMO
- MP-101 HOT WATER TANKS – HOSPITAL
- MP-201 HOT WATER TANKS – LAUNDRY
- M-501 MECHANICAL DETAILS
- M-601 MECHANICAL CONTROLS
- M-602 MECHANICAL CONTROLS

**ELECTRICAL**
- E-001 ELECTRICAL LEGENDS AND ABBREVIATIONS
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1.1 GENERAL INTENTION
A. Contractor shall furnish all labor and materials and perform work for Project 668-16-101, “Replace Hot Water Tanks, Buildings 1 & 2” as required by drawings and specifications.
B. Visits to the site by Bidders may be made only by appointment with the Medical Center Contracting Officer’s Representative (COR).
C. Offices of William Wilson Architects, Riverside Engineering, and Trindera Engineering 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 the Contracting Officer or his/her duly authorized representative.
D. Prior to commencing work, general contractor shall provide proof that a OSHA certified “competent person” (CP) (29 CFR 1926.20(b)(2) will maintain a presence at the work site whenever the general or subcontractors are present.

E. Training:
1. All employees of general contractor or subcontractors shall have at least the 10-hour OSHA certified Construction Safety course and/or other relevant competency training. All contractor Supervisors and Foremen who oversee construction work shall have the 30-hour OSHA certified Construction Safety course.
2. Submit training records of all such employees for approval before the start of work.

1.2 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR
A. Contractor shall obtain drawings and specifications by accessing the “Fed Biz Opps” website (http://www.fbo.gov) and printing documents as needed.

1.3 CONSTRUCTION SECURITY REQUIREMENTS
A. Security Plan:
1. The security plan submitted before starting any work defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.
B. Security Procedures:
1. All employees of the general contractor and subcontractors are forbidden to enter the project site without an ID badge. **ID badges are issued by the federal government and may take two weeks to process.** Plan accordingly: Construction delays
caused by badge processing are entirely the fault of the contractor. There is no cost for the badges. The application process for an ID badge includes:

- Finger printing by VA Police
- A federal background check
- A photo of the individual, taken by VA.

2. Employees of the general contractor and subcontractors are subject to VA federal laws and may also be subject to inspection of their personal effects when entering or leaving the project site.

3. No photography of VA premises is allowed without written permission of the Contracting Officer.

4. VA reserves the right to close down or shut down the project site and order General Contractor’s employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the COR for the purpose of security inspections of every area of project including tool boxes for any non-VA locks in use. Keys for VA locks are available for contractor use at no cost.

D. Document Control:

1. 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.

E. Motor Vehicle Restrictions

1. Employees of the contractor and subcontractors shall only park in designated areas on the far west side of the property as defined by the COR. Parking in the loading dock area and near the boiler plant is extremely limited and may only be used by trucks on/offload tools and supplies for short periods but must be moved immediately afterwards. Any need for extended parking in one of these locations must be coordinated with the COR.

1.4 FIRE SAFETY

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

   E84-2009.........................Surface Burning Characteristics of Building Materials
2. National Fire Protection Association (NFPA):

   10-2010 ................................ Standard for Portable Fire Extinguishers
   30-2008 ................................ Flammable and Combustible Liquids Code
   51B-2009 ................................ Standard for Fire Prevention During Welding, Cutting and Other Hot Work
   70-2011 ................................ National Electrical Code
   241-2009 .............................. Standard for Safeguarding Construction, Alteration, and Demolition Operations

3. Occupational Safety and Health Administration (OSHA):

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

B. Fire Safety Plan: Establish and maintain a 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 the COR and Safety Manager for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor’s competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the COR that individuals have undergone contractor’s safety briefing.

C. 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. Maintain egress routes to the stairwells for all building occupants throughout construction. Negative air ducting routed through corridors must not impede building egress.

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


F. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B.

1. Coordinate and obtain permits from the COR, the Safety Manager, or Safety Specialist at least 4 hours in advance. The Contractor and the COR will evaluate each situation and decide on the proper course of action. If there is combustible debris, combustible material adjacent to the work area, any of which could be flammable, the Contractor will provide a continuous fire watch.
2. The fire watch will inspect the area for both obvious and concealed sources of combustion during and for a minimum of thirty (30) minutes after completion of the work.

G. Fire/Smoke Wall Penetration Permits are required for any penetration through a fire or smoke barrier. Notify the COR of any pre-existing penetrations that are missing fire caulking. All penetrations must be sealed with Hilti products (no substitutions) using the appropriate assembly and labeled correctly.

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

I. Smoking: Smoking is prohibited except in designated smoking areas.

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

K. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

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 Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

B. Storage space is extremely limited in building one and shall be limited to the mechanical room under construction. Access to the other valves, panels, and equipment in the room shall be maintained throughout the project to the maximum extent practical.

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

D. Execute work so as to interfere as little as possible with normal functioning of the Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure is limited to 4:30 PM – 9:00 PM M-F or daytime hours on Saturday or Sunday.

1. Do not store materials and equipment in other than assigned areas.

2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. The building one loading dock is very small and all use must be coordinated with other deliveries via the COR. For large items such as the old tanks, anticipate late afternoon/evening or weekend loading dock availability.
3. Work hours in building one will be limited by the noise restrictions above, loading dock restrictions, and normal hospital operations. Work contained within the mechanical room can generally be performed during the day but plan on evening or weekend hours for deliveries, abatement, utility shutdowns, and noisy work. Work hours in building two have no limitations.

E. Buildings will be occupied during performance of work. Contractor shall coordinate with the VA as needed to maintain operations during construction.

F. Utilities Services: Maintain utility services for the Medical Center at all times except for shutdowns coordinated with the VA. Provide all labor, materials, and equipment to assure continuity of services.
   1. No utility service may be interrupted without prior approval of the COR. Submit a written request to the COR for any shutdown at least 48 hours in advance. Shutdown times will be scheduled to cause the least disruption to hospital operations.

G. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, shall be demolished entirely back to the main or source unless noted otherwise. Those which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged.

H. If shut-off valves are concealed, such as in acoustical ceilings, a sign shall be placed in a visible location.

I. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
   1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.

1.7 ALTERATIONS

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR of areas in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by the Contractor and COR to the Contracting Officer. This report shall:
   1. Note any discrepancies between drawings and existing conditions at site.
   2. 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.
   3. Include digital photographs as needed to document existing conditions.

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 and VAAR 852.236-88).

C. Re-Survey: Prior to final inspection the Contractor and COR together shall make a thorough re-survey of the areas involved. They shall furnish a report on conditions then existing 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, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workers in executing work of this contract.

D. Protection: Provide the following protective measures:

1. 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.

2. 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 INFECTION CONTROL REQUIREMENTS

A. Comply with all requirements for Class III containment per the following worksheet. Submit an infection control plan for VA approval prior to beginning any work. Failure to maintain barriers properly will result in an immediate stop in construction until remedial measures are taken. Repeat infractions are grounds for contract termination.

PROJECT NAME: 668-16-101 Replace Hot Water Tanks

Infection Control Risk Assessment
Matrix of Precautions for Construction & Renovation

Step One:
Using the following table, identify the Type of Construction Project Activity (Type A-D)
### Inspection and Non-Invasive Activities.
Includes, but is not limited to:
- removal of ceiling tiles for visual inspection limited to 1 tile per 50 square feet
- painting (but not sanding)
- wallcovering, electrical trim work, minor plumbing, and activities which do not generate dust or require cutting of walls or access to ceilings other than for visual inspection.

### Small scale, short duration activities which create minimal dust
Includes, but is not limited to:
- installation of telephone and computer cabling
- access to chase spaces
- cutting of walls or ceiling where dust migration can be controlled.

### Work that generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies
Includes, but is not limited to:
- sanding of walls for painting or wall covering
- removal of floorcoverings, ceiling tiles and casework
- new wall construction
- minor duct work or electrical work above ceilings
- major cabling activities
- any activity which cannot be completed within a single workshift.

### Major demolition and construction projects
Includes, but is not limited to:
- activities which require consecutive work shifts
- requires heavy demolition or removal of a complete cabling system
- new construction.

**STEP 1:** TYPE D
Step Two:
Using the following table, *identify the Patient Risk Groups* that will be affected.
If more than one risk group will be affected, select the higher risk group:

<table>
<thead>
<tr>
<th>Low Risk</th>
<th>Medium Risk</th>
<th>High Risk</th>
<th>Highest Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Office areas</td>
<td>• Cardiology</td>
<td>• CCU</td>
<td>• Any area caring for immunocompromised patients</td>
</tr>
<tr>
<td></td>
<td>• Echocardiography</td>
<td>• Emergency Room</td>
<td>• Burn Unit</td>
</tr>
<tr>
<td></td>
<td>• Endoscopy</td>
<td>• Labor &amp; Delivery</td>
<td>• Cardiac Cath Lab</td>
</tr>
<tr>
<td></td>
<td>• Nuclear Medicine</td>
<td>• Laboratories (specimen)</td>
<td>• Central Sterile Supply</td>
</tr>
<tr>
<td></td>
<td>• Physical Therapy</td>
<td>• Newborn Nursery</td>
<td>• Intensive Care Units</td>
</tr>
<tr>
<td></td>
<td>• Radiology/MRI</td>
<td>• Outpatient Surgery</td>
<td>• Medical Unit</td>
</tr>
<tr>
<td></td>
<td>• Respiratory Therapy</td>
<td>• Pediatrics</td>
<td>• Negative pressure isolation rooms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pharmacy</td>
<td>• Oncology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Post Anesthesia Care Unit</td>
<td>• Operating rooms including C-section rooms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Surgical Units</td>
<td></td>
</tr>
</tbody>
</table>

Step 2: **Low Risk**

Step Three: *Match the Patient Risk Group* *(Low, Medium, High, Highest)* with the planned …
*Construction Project Type* *(A, B, C, D)* on the following matrix, to find the …
*Class of Precautions* *(I, II, III or IV)* or level of infection control activities required.
*Class I-IV* or *Color-Coded Precautions* are delineated on the following page.

**IC Matrix - Class of Precautions: Construction Project by Patient Risk**

<table>
<thead>
<tr>
<th>Patient Risk Group</th>
<th>TYPE A</th>
<th>TYPE B</th>
<th>TYPE C</th>
<th>TYPE D</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW Risk Group</td>
<td>I</td>
<td>II</td>
<td>II</td>
<td>III/IV</td>
</tr>
<tr>
<td>MEDIUM Risk Group</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
</tr>
<tr>
<td>HIGH Risk Group</td>
<td>I</td>
<td>II</td>
<td>III/IV</td>
<td>IV</td>
</tr>
<tr>
<td>HIGHEST Risk Group</td>
<td>II</td>
<td>III/IV</td>
<td>III/IV</td>
<td>IV</td>
</tr>
</tbody>
</table>

Note: Infection Control approval will be required when the Construction Activity and Risk Level indicate that *Class III* or *Class IV* control procedures are necessary.

Step 3: **Class III**
<table>
<thead>
<tr>
<th>Class</th>
<th>During Construction Project</th>
<th>Upon Completion of Project</th>
</tr>
</thead>
</table>
| Class I | 1. Execute work by methods to minimize raising dust from construction operations.  
2. Immediately replace a ceiling tile displaced for visual inspection | 1. VA COR, Safety, IC, or other pertinent employees will inspect all IC barriers prior to any work being performed. |
| Class II | 1. Provide active means to prevent airborne dust from dispersing into atmosphere.  
2. Water mist work surfaces to control dust while cutting.  
3. Seal unused doors with duct tape.  
4. Block off and seal air vents.  
5. Place dust mat at entrance and exit of work area  
6. Remove or isolate HVAC system in areas where work is being performed. | 1. Wipe work surfaces with disinfectant.  
2. Contain construction waste before transport in tightly covered containers.  
3. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.  
4. Remove isolation of HVAC system in areas where work is being performed.  
5. VA COR, Safety, IC, or other pertinent employees will inspect all IC barriers prior to any work being performed. |
| Class III | 1. Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.  
2. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins.  
3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.  
5. Cover transport receptacles or carts. Tape covering unless solid lid. | 1. Do not remove barriers from work area until completed project is inspected by the owner’s Safety Department and Infection Control Department and thoroughly cleaned by the owner’s Environmental Services Department.  
2. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.  
3. Vacuum work area with HEPA filtered vacuums.  
4. Wet mop area with disinfectant.  
5. Remove isolation of HVAC system in areas where work is being performed.  
6. VA COR, Safety, IC, or other pertinent employees will inspect all IC barriers prior to any work being performed. |
### General Requirements

| Class IV | 1. Isolate HVAC system in area where work is being done to prevent contamination of duct system.  
2. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins.  
3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.  
4. Seal holes, pipes, conduits, and punctures appropriately.  
5. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site.  
6. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.  
7. Do not remove barriers from work area until completed project is inspected by the owner’s Safety Department and Infection Control Department and thoroughly cleaned by the owner’s Environmental Services Department. | 1. Remove barrier material carefully to minimize spreading of dirt and debris associated with construction.  
2. Contain construction waste before transport in tightly covered containers.  
3. Cover transport receptacles or carts. Tape covering unless solid lid  
4. Vacuum work area with HEPA filtered vacuums.  
5. Wet mop area with disinfectant.  
6. Remove isolation of HVAC system in areas where work is being performed.  
7. VA COR, Safety, IC, or other pertinent employees will inspect all IC barriers prior to any work being performed. |

### Step 4. Identify the areas surrounding the project area, assessing potential impact

<table>
<thead>
<tr>
<th>Unit Below</th>
<th>Unit Above</th>
<th>Lateral</th>
<th>Lateral</th>
<th>Behind</th>
<th>Front</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>Director’s Suite</td>
<td>Office</td>
<td>Electric room</td>
<td>Warehouse</td>
<td>Corridor</td>
</tr>
</tbody>
</table>

### Step 5. Identify specific site of activity eg, patient rooms, medication room, etc.

**Mechanical room**

### Step 6. Identify issues related to: ventilation, plumbing, electrical in terms of the occurrence of probable outages.

Temporary reduction in domestic hot water capacity. Temporary steam outage.

### Step 7. Identify containment measures, using prior assessment. What types of barriers? (Eg, solids wall barriers); Will HEPA filtration be required?

Visqueen and zipwalls. Negative air and/or air scrubbers required.

(Note: Renovation/construction area shall be isolated from the occupied areas during construction and shall be negative with respect to surrounding areas)
Step 8. Consider potential risk of water damage. Is there a risk due to compromising structural integrity? (eg, wall, ceiling, roof)
N/A

Step 9. Work hours: Can or will the work be done during non-patient care hours? 
Some night and weekend work to minimize impact to the facility.

Step 10. Do plans allow for adequate number of isolation/negative airflow rooms?
N/A

Step 11. Do the plans allow for the required number & type of handwashing sinks?
N/A

Step 12. Does the infection control staff agree with the minimum number of sinks for this project?
N/A

Step 13. Does the infection control staff agree with the plans relative to clean and soiled utility rooms?
N/A

Step 14. Plan to discuss the following containment issues with the project team.
Eg, traffic flow, housekeeping, debris removal (how and when)
Corridor traffic to occur after clinic hours. Corridors to be thoroughly cleaned after each shift
Only use the elevator when required.

Appendix: Identify and communicate the responsibility for project monitoring that includes infection control concerns and risks. The ICRA may be modified throughout the project.
Revisions must be communicated to the Project Manager.
Infection Control Construction Permit

<table>
<thead>
<tr>
<th>Location of Construction:</th>
<th>Permit No:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Coordinator:</td>
<td>Project Start Date:</td>
</tr>
<tr>
<td>Contractor Performing Work</td>
<td>Estimated Duration:</td>
</tr>
<tr>
<td>Supervisor:</td>
<td>Permit Expiration Date:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
<th>CONSTRUCTION ACTIVITY</th>
<th>YES</th>
<th>NO</th>
<th>INFECTION CONTROL RISK GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE A: Inspection, non-invasive activity</td>
<td>GROUP 1: Low Risk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPE B: Small scale, short duration, moderate to high levels</td>
<td>GROUP 2: Medium Risk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPE C: Activity generates moderate to high levels of dust, requires greater 1 work shift for completion</td>
<td>GROUP 3: Medium/High Risk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPE D: Major duration and construction activities Requiring consecutive work shifts</td>
<td>GROUP 4: Highest Risk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Class I
1. Execute work by methods to minimize raising dust from construction operations.
2. Immediately replace any ceiling tile displaced for visual inspection.
3. Minor Demolition for Remodeling

### Class II
1. Provides active means to prevent air-borne dust from dispersing into atmosphere
2. Water mist work surfaces to control dust while cutting.
3. Seal unused doors with duct tape.
4. Block off and seal air vents.
5. Wipe surfaces with disinfectant.
6. Contain construction waste before transport in tightly covered containers.
7. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.
8. Place dust mat at entrance and exit of work area.
9. Remove or isolate HVAC system in areas where work is being performed.
10. Contain construction waste before transport in tightly covered containers.
11. Cover transport receptacles or carts. Tape covering.
12. Remove or isolate HVAC system in areas where work is being performed.

### Class III
1. Obtain infection control permit before construction begins.
2. Isolate HVAC system in area where work is being done to prevent contamination of the duct system.
3. Complete all critical barriers or implement control cube method before construction begins.
4. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.
5. Do not remove barriers from work area until complete project is thoroughly cleaned by Env. Services Dept.
6. Vacuum work with HEPA filtered vacuums.
7. Wet mop with disinfectant.
8. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.
10. Cover transport receptacles or carts. Tape covering.
11. Remove or isolate HVAC system in areas where work is being performed.

### Class IV
1. Obtain infection control permit before construction begins.
2. Isolate HVAC system in area where work is being done to prevent contamination of duct system.
3. Complete all critical barriers or implement control cube method before construction begins.
4. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.
5. Seal holes, pipes, conduits, and punctures appropriately.
6. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site.
7. All personnel entering work site are required to wear shoe covers.
8. Do not remove barriers from work area until completed project is thoroughly cleaned by the Environmental Service Dept.
9. Vacuum work area with HEPA filtered vacuums.
10. Wet mop with disinfectant.
11. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.
12. Contain construction waste before transport in tightly covered containers.
13. Cover transport receptacles or carts. Tape covering.
14. Remove or isolate HVAC system in areas where work is being done.

### Additional Requirements:

<table>
<thead>
<tr>
<th>Date</th>
<th>Initials</th>
</tr>
</thead>
</table>

Exceptions/Additions to this permit are noted by attached memoranda

Permit Request By: Permit Authorized By:

Date: Date:
1.9 DISPOSAL AND RETENTION

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

1. 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 shall be removed by Contractor from the Medical Center.

1.10 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.

1.11 RESTORATION

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

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

1.12 AS-BUILT DRAWINGS

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

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

C. Contractor shall deliver the approved completed set of as-built drawings to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.
1.13 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. The Contractor shall conscientiously conserve any utilities furnished without charge.

1.14 INSTRUCTIONS

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

B. Manuals: Maintenance and operating manuals for each separate piece of equipment shall be delivered to the COR at substantial completion. Provide two paper copies and one electronic copy (PDF.) The paper copies shall be bound in hard-back binders. 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 andreassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions 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 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.

1.15 ASBESTOS FREE CONSTRUCTION MATERIALS

A. The General Contractor shall ensure that no materials containing asbestos are installed under this contract. The General Contractor shall be liable for all costs associated with
the removal and replacement of any such materials placed regardless of the date of discovery.

1.16 HAZARDOUS MATERIALS

A. The General Contractor is required to obtain and maintain a comprehensive file on the jobsite of “Material Safety Data Sheets” (MSDS) for all hazardous or potentially hazardous materials utilized in the construction process. Copies of the individual MSDS sheets will be transmitted to the COR as they are obtained. No hazardous or potentially hazardous materials will be transported to or utilized on the jobsite without the applicable MSDS sheets being on file. The Contractor shall take all precautions identified by the MSDS for hazardous materials to insure the safety and health of all Contractor employees, VA employees, patients, and visitors.

1.17 GREEN ENVIRONMENTAL MANAGEMENT SYSTEM (GEMS)

A. GEMS Awareness Training for Contractors

1. 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).

2. 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 the 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.

3. 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.

4. 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 COTR for recordkeeping.

• Activities which may result in contaminants (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, and pesticides). 40 CFR Part 273

• Work on refrigerators, air conditioners, other chiller units, or other sources of ozone depleting substances. 40 CFR Section 82
B. Requirement to Maintain Record of Materials Reused or Recycled

**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 Contractor’s Project Superintendent. At the conclusion of the project, this form shall be reviewed and signed by the Project COR with a copy given to the GEMS Coordinator for their records.

<table>
<thead>
<tr>
<th>Materials Reused or Recycled Record</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Number:</strong></td>
</tr>
<tr>
<td><strong>Project Location:</strong></td>
</tr>
<tr>
<td><strong>Page of</strong></td>
</tr>
<tr>
<td><strong>Date:</strong></td>
</tr>
<tr>
<td><strong>Project Superintendent:</strong></td>
</tr>
<tr>
<td><strong>Material being reused/recycled:</strong></td>
</tr>
<tr>
<td><strong>Reused/Recycled</strong></td>
</tr>
<tr>
<td><strong>Quantity</strong></td>
</tr>
<tr>
<td><strong>Location Taken</strong></td>
</tr>
<tr>
<td><strong>Comments</strong></td>
</tr>
<tr>
<td><strong>Project Supervisor’s Signature:</strong></td>
</tr>
<tr>
<td><strong>Project COR’s Signature:</strong></td>
</tr>
<tr>
<td><strong>Cc:</strong> GEMS Coordinator</td>
</tr>
</tbody>
</table>

C. Examples of Construction Waste that is Potentially Hazardous Waste

- Used oil, hydraulic fluid, diesel fuel, or jet fuel
- Soil contaminated with toxic or hazardous pollutants, like those listed above
- Waste paints, varnish, solvents, sealers, thinners, resins, roofing cement, adhesives, machinery lubricants, and caulk
• Clean up materials (such as rags) contaminated with the items listed above
• Drums and containers that once contained the items listed above
• Waste carpeting (due to formaldehyde contents)
• Lead-based paint, lead flashing, or lead solder
• Computer monitors and televisions with cathode ray tubes
• Gypsum drywall (due to sulfate)
• Mercury-containing demolition wastes, (e.g. fluorescent bulbs, broken mercury switches, batteries or thermostats
• Other items that may have inseparable hazardous constituents

D. Examples of Items that may be reused*
• Doors (if in good shape), door locks
• Light fixtures, electronics (nurse call wiring, other wiring, etc.), electrical panels, breakers
• Sinks, toilets, and plumbing fixtures
• Accessories (mirrors and towel dispensers)
• Handrails and corner guards

*Items that no longer meet codes, safety, or other requirements may not be reused.

- - - E N D - - -
SECTION 01 33 23
SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.

1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.

1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:

A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;

B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;

C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.

1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.

1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by Resident Engineer on behalf of the Contracting Officer.

1-6. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES.
(FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

1-7. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.

1-8. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.

A. Submit samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.

1. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.

2. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.

B. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.

C. Approved samples will be kept on file by the Resident Engineer at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved
samples that are not requested for return by Contractor will be discarded after completion of contract.

D. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.

1. For each drawing required, submit one legible photographic paper or vellum reproducible.
2. Reproducible shall be full size.
3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
5. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
6. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.

1-9. Samples, shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to the COR.

--- END ---
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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 Engineers (ASSE):

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

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

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

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

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

D. The Facilities Guidelines Institute (FGI):


E. National Fire Protection Association (NFPA):

10-2013............Standard for Portable Fire Extinguishers

30-2012............Flammable and Combustible Liquids Code

51B-2014............Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2014............National Electrical Code

70B-2013............Recommended Practice for Electrical Equipment Maintenance
F. The Joint Commission (TJC)


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. VHA Directive 2005-007

1.2 DEFINITIONS:

A. 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)).

B. "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.
C. High Visibility Accident. Any mishap which may generate publicity or high visibility.

D. Accident/Incident Criticality Categories:

No impact - near miss incidents that should be investigated but are not required to be reported to the VA;

Minor incident/impact - incidents that require first aid or result in minor equipment damage (less than $5000). These incidents must be investigated but are not required to be reported to the VA;

Moderate incident/impact - Any work-related injury or illness that results in:

1. Days away from work (any time lost after day of injury/illness onset);
2. Restricted work;
3. Transfer to another job;
4. Medical treatment beyond first aid;
5. Loss of consciousness;
6. 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,
7. any incident that leads to major equipment damage (greater than $5000).

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

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

1.3 REGULATORY REQUIREMENTS:
A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A10.34, and all applicable [federal, state, and local] laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the Contracting Officer Representative.

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

B. The APP shall be prepared as follows:

1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.
2. Address both the Prime Contractors and the subcontractors work operations.

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

4. Address all the elements/sub-elements and in order as follows:
   
a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:

   1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);

   2) Plan approver (company/corporate officers authorized to obligate the company);

   3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).

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

   1) Contractor;

   2) Contract number;

   3) Project name;

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

   c. **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor’s written safety program goals, objectives, and accident experience goals for this contract should be provided.
d. **RESPONSIBILITIES AND LINES OF AUTHORITIES.** Provide the following:

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

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

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

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

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

6) Lines of authority;

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

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

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

2) Safety responsibilities of subcontractors and suppliers.

f. **TRAINING.**

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

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

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

4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

g. SAFETY AND HEALTH INSPECTIONS.

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

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

h. ACCIDENT/INCIDENT INVESTIGATION & REPORTING. The Contractor shall conduct mishap investigations of all Moderate and Major as well as all High Visibility Incidents. The APP shall include accident/incident investigation procedure and identify person(s) responsible to provide the following to the Contracting Officer Representative:

1) Exposure data (man-hours worked);

2) Accident investigation, reports;

3) Project site injury and illness logs.

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

1) Emergency response;
2) Contingency for severe weather;
3) Fire Prevention;
4) Medical Support;
5) Posting of emergency telephone numbers;
6) Prevention of alcohol and drug abuse;
7) Site sanitation (housekeeping, drinking water, toilets);
8) Night operations and lighting;
9) Hazard communication program;
10) Welding/Cutting "Hot" work;
11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);
12) General Electrical Safety;
13) Hazardous energy control (Machine LOTO);
14) Site-Specific Fall Protection & Prevention;
15) Asbestos abatement;
16) Lead abatement;
17) Crane Critical lift;
18) Respiratory protection;
19) Health hazard control program;
20) Heat/Cold Stress Monitoring;
21) Demolition plan;
22) Public (Mandatory compliance with ANSI/ASSE A10.34-2012).
C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 (fifteen) calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

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

E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer Representative. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment.

1.5 ACTIVITY HAZARD ANALYSES (AHAS):

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

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

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

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

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

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

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

3. Submit AHAs to the or Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 (fifteen) calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.
4. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

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

1.6 PRECONSTRUCTION CONFERENCE:

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

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

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

SPEC WRITER NOTE: If the contract will involve (a) work of a long duration or hazardous nature, or (b) performance within a Government facility that on the advice of VA construction safety representatives involves hazardous operations that might endanger the safety of the public, patients and/or Government personnel or property, the SSHO and...
Superintendent and/or Quality Control Manager must be separate persons (See Section 1.7(C) for choice).

1.7 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.

- - - E N D - - -
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:

DEPARTMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
425 Eye Street N.W, (sixth floor)
Washington, DC 20001
Telephone Numbers: (202) 632-5249 or (202) 632-5178
Between 9:00 AM - 3:00 PM
1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

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

AABC  Associated Air Balance Council  
  http://www.aabchq.com

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

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

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

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

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

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

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

http://www.asse-plumbing.org

ASTM  American Society for Testing and Materials

http://www.astm.org

AWS  American Welding Society

http://www.aws.org

AWWA  American Water Works Association

http://www.awwa.org

EEI  Edison Electric Institute

http://www.eei.org

EPA  Environmental Protection Agency

http://www.epa.gov

FM  Factory Mutual Insurance

http://www.fmglobal.com

GSA  General Services Administration

http://www.gsa.gov

HI  Hydraulic Institute

http://www.pumps.org

ICBO  International Conference of Building Officials

http://www.icbo.org

ICEA  Insulated Cable Engineers Association Inc.

http://www.icea.net

IEEE  Institute of Electrical and Electronics Engineers

http://www.ieee.org

MSS  Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

http://www.mss-hq.com
NAPHCCL Plumbing-Heating-Cooling Contractors Association  
http://www.phccweb.org.org

NBS National Bureau of Standards  
See - NIST

NBBPVI National Board of Boiler and Pressure Vessel Inspectors  
http://www.nationboard.org

NEC National Electric Code  
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association  
http://www.nema.org

NFPA National Fire Protection Association  
http://www.nfpa.org

NIH National Institute of Health  
http://www.nih.gov

NIST National Institute of Standards and Technology  
http://www.nist.gov

OSHA Occupational Safety and Health Administration  
Department of Labor  
http://www.osha.gov

PCA Portland Cement Association  
http://www.portcement.org

SMACNA Sheet Metal and Air-Conditioning Contractors National Association, Inc.  
http://www.smacna.org

STI Steel Tank Institute  
http://www.steeltank.com

UL Underwriters' Laboratories Incorporated  
http://www.ul.com

- - - E N D - - -
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:
   1. Waste Management Plan development and implementation.
   2. Techniques to minimize waste generation.
   4. Salvage of existing materials and items for reuse or resale.
   5. Recycling of materials that cannot be reused or sold.

D. 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.
   5. Engineered wood products (plywood, particle board and I-joists, etc).
   6. Metal products (eg, steel, wire, beverage containers, copper, etc).
   7. Cardboard, paper and packaging.
   9. Plastics (eg, ABS, PVC).
   10. Carpet and/or pad.
   12. Insulation.
   13. Paint.
   14. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

C. Lead Paint: Section 02 83 33.13, LEAD BASED PAINT REMOVAL AND DISPOSAL.
1.3 QUALITY ASSURANCE

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

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. The Whole Building Design Guide website http://www.wbdg.org/tools/cwm.php provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.

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 Resident Engineer 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.
   c. The names and locations of mixed debris reuse and recycling facilities or sites.
   d. The names and locations of trash disposal landfill facilities or sites.
   e. 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.

1.6 APPLICABLE PUBLICATIONS
A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
B. U.S. Green Building Council (USGBC):
   LEED Green Building Rating System for New Construction

1.7 RECORDS
Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS

2.1 MATERIALS
A. List of each material and quantity to be salvaged, recycled, reused.
B. List of each material and quantity proposed to be taken to a landfill.
C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION
A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL
A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT
A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

- - - E N D - - -
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. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.

C. 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 contract 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.

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

1.2 CONTRACTUAL RELATIONSHIPS

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

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

C. The commissioning process described herein has been developed to
recognize that, in the execution of the Commissioning Process, the
Commissioning Agent must develop effective methods to communicate with
every member of the construction team involved in delivering
commissioned systems while simultaneously respecting the exclusive
contract authority of the Contracting Officer and Resident Engineer.

1.3 RELATED WORK
A. Section 01 00 00 GENERAL REQUIREMENTS.
B. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
C. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.
D. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.
E. Section 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS.
F. This Section includes general requirements that apply to
implementation of commissioning without regard to systems,
subsystems, and equipment being commissioned.

1.4 (NOT USED)

1.5 ACRONYMS

Acronyms used have same meaning as commonly used in industry.

1.6 DEFINITIONS

Undefined terms have same meaning as commonly used in industry.

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:

<table>
<thead>
<tr>
<th>Systems to be Commissioned</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plumbing</strong></td>
<td></td>
</tr>
<tr>
<td>See Divisions 22 &amp; 25</td>
<td>All Plumbing systems specified in Divisions 22 &amp; 25</td>
</tr>
<tr>
<td><strong>HVAC</strong></td>
<td></td>
</tr>
<tr>
<td>See Division 23</td>
<td>All HVAC systems specified in Division 23</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td></td>
</tr>
<tr>
<td>See Division 26</td>
<td>All Electrical systems specified in Division 26</td>
</tr>
</tbody>
</table>

1.8 COMMISSIONING TEAM

A. The commissioning team shall consist of, but not be limited to:
   1. Members Appointed by Contractor
   2. Members Appointed by VA including Commissioning Agent commissioned under a separate contract and user representatives of the facility.
   3. A/E: Representative of the Architect / engineering design team.

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.
   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.
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.


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
B. Systems Functional Performance Test Procedures
C. Pre-Functional Checklists
D. Test and Inspection Reports
E. Corrective Action Documents
F. Commissioning Issues Log
G. Final Commissioning Report
H. Addendum to Final Commissioning Report
I. Systems Manual

1.13 SUBMITTALS

A. Preliminary Commissioning Plan Submittal: The Commissioning Agent will prepare a Preliminary Commissioning Plan based on the final Construction Documents.

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
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.

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

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

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

G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three copies of the preliminary commissioning report.

H. Final Commissioning Report Submittal: The Commissioning Agent will submit the final commissioning report to 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.

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.

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.
B. Scheduling: The Contractor shall work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule.

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.

PART 3 - EXECUTION

3.1 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES
A. The roles and responsibilities for the Commissioning Team members during the Construction Phase are described in Paragraphs 1.9, 1.10 and 1.11.

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
   2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment
   3. Sensor and Actuator Calibration
      a. All field installed temperature, relative humidity, CO2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 22, Division 23 and Division 26 specifications.
      b. All procedures used shall be fully documented on the Pre-Functional Checklists.
   4. Execution of Equipment Startup
      a. The Contractor shall schedule startup and checkout with the VA and Commissioning Agent

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.
   B. 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.

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 agreed between Contractor, Commissioning Agent and VA.
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.

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.

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.
B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form.
C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of 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.
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.

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.

3.9 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA’s Resident Engineer, VA’s Operations and Maintenance personnel, and the Contractor.

B. The Contractor shall provide training and demonstration as required by other Division 22, Division 23 and Division 26.

C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:

1. Instruction Program: Outline of instructional program for demonstration and training.
2. Qualification Data: Qualifications for facilitator and/or instructor.
3. Attendance Record: For each training module, list of participants and length of instruction time.
4. Evaluations: For each participant and for each training module, results and documentation of performance-based test.

D. Quality Assurance:

1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content.
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.

E. Training Coordination:

1. Coordinate instruction schedule with VA’s operations

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.

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.

----- END -----

GENERAL COMMISSIONING REQUIREMENTS 01 91 00 - 11
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. Lead Paint: Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
F. Construction Waste Management: Section 017419 CONSTRUCTION WASTE MANAGEMENT.
G. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.

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. 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.
2. 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 Resident Engineer’s approval.

H. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

1.4 UTILITY SERVICES:
A. Demolish and remove outside utility service lines if shown to be removed.
B. Remove any 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 items noted to be removed

B. All demolition debris 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. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

C. 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. The removal of hazardous material shall be referred to Hazardous Materials specifications.

3.2 CLEAN-UP:

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Resident Engineer. Clean-up shall include off the Medical Center disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

--- END ---
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PART 1 - GENERAL

1.1 SUMMARY OF THE WORK

1.1.1 CONTRACT DOCUMENTS AND RELATED REQUIREMENTS

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

1.1.2 EXTENT OF WORK

A. Estimated quantities of asbestos containing materials to be abated is not available. The Contractor shall satisfy himself as the actual quantities to be abated. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.

B. Removal, clean-up and disposal of asbestos containing materials (ACM) and asbestos/waste contaminated elements in an appropriate regulated area for the following approximate quantities: To be determined by Contractor.

C. Encapsulation of ACM in the following quantities: To be determined by Contractor.

D. Enclosure of ACM in the following quantities: To be determined by Contractor.

1.1.3 RELATED WORK

A. Section 07 84 00, FIRESTOPPING.
B. Section 02 41 00, DEMOLITION.
C. Division 22, PLUMBING.
D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING / Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
E. Section 23 07 11, HVAC INSULATION.
F. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING / Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING / Section 22 11 00, FACILITY WATER DISTRIBUTION.
G. Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.

1.1.4 TASKS

The work tasks are summarized briefly as follows:

A. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, regulated
area preparations, emergency procedures arrangements, and standard operating procedures for asbestos abatement work.

B. Abatement activities including removal, encapsulation, enclosure, clean-up and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.

C. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.

1.1.5 CONTRACTORS USE OF PREMISES

A. 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.

B. 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. Limitations of use shall apply to existing facilities as directed by the COR and as shown on drawings.

1.2 VARIATIONS IN QUANTITY

The quantities and locations of ACM if 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 (+/-5%) 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

If the Contracting Officer; their field representative; (the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal Stop Asbestos Removal Order, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed ACM. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as it is practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage will
continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor’s competent person to the VA Contracting Office or field representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities:

A. Airborne PCM analysis results equal to or greater than 0.01 f/cc outside a regulated area or >0.05 f/cc inside a regulated area;
B. breach or break in regulated area containment barrier(s);
C. less than -0.02” WCG pressure in the regulated area;
D. serious injury/death at the site;
E. fire/safety emergency at the site;
F. respiratory protection system failure;
G. power failure or loss of wetting agent; or
H. any visible emissions observed outside the regulated area.

1.4 DEFINITIONS

1.4.1 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.

1.4.2 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 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.
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 2 is used to determine the fiber levels in air. For personal samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis. NIOSH Method 7402 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 for PCM (Phase Contrast Microscopy) and polycarbonate for TEM (Transmission Electron Microscopy)

**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 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 the 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 plastic sheeting secured in place at openings such as doors, windows, or any other opening into the regulated area.

**Primary Barrier** - Plastic barriers placed over critical barriers and exposed directly to abatement work.

**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 be 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.

**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.

**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/markd in accordance with EPA, OSHA and DOT requirements.

**Disturbance** - Activities 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 impervious 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 of asbestos as determined using the method specified in appendix A, Subpart F, 40 CFR 763, section 1, 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 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.

**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" 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.

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

**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 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, and respirators.

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

**Polarized light microscopy (PLM)** - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type(s) 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 (b).

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) 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 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-7.1-1989.

Surfacing ACM – A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, 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 be a Certified Industrial Hygienist (CIH).

VA Representative – The VA official responsible for ongoing project work.

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.

1.4.3 REFERENCED STANDARDS ORGANIZATIONS

The following acronyms or abbreviations as referenced in contract/specification documents are defined to mean the associated names. Names and addresses may be subject to change.

A. VA Department of Veterans Affairs
   810 Vermont Avenue, NW
   Washington, DC 20420

B. AIHA American Industrial Hygiene Association
   2700 Prosperity Avenue, Suite 250
   Fairfax, VA 22031
   703-849-8888

C. ANSI American National Standards Institute
   1430 Broadway
   New York, NY 10018
   212-354-3300

D. ASTM American Society for Testing and Materials
   1916 Race St.
   Philadelphia, PA 19103
   215-299-5400
E. CFR Code of Federal Regulations
   Government Printing Office
   Washington, DC 20420

F. CGA Compressed Gas Association
   1235 Jefferson Davis Highway
   Arlington, VA 22202
   703-979-0900

G. CS Commercial Standard of the National Institute of Standards and Technology (NIST)
   U. S. Department of Commerce
   Government Printing Office
   Washington, DC 20420

H. EPA Environmental Protection Agency
   401 M St., SW
   Washington, DC 20460
   202-382-3949

I. MIL-STD Military Standards/Standardization Division
   Office of the Assistant Secretary of Defense
   Washington, DC 20420

J. NIST National Institute for Standards and Technology
   U. S. Department of Commerce
   Gaithersburg, MD 20234
   301-921-1000

K. NEC National Electrical Code (by NFPA)

L. NEMA National Electrical Manufacturer's Association
   2101 L Street, N.W.
   Washington, DC 20037

M. NFPA National Fire Protection Association
   1 Batterymarch Park
   P.O. Box 9101
   Quincy, MA 02269-9101
   800-344-3555

N. NIOSH National Institutes for Occupational Safety and Health
   4676 Columbia Parkway
   Cincinnati, OH 45226
   513-533-8236

O. OSHA Occupational Safety and Health Administration
   U.S. Department of Labor
   Government Printing Office
   Washington, DC 20402

P. UL Underwriters Laboratory
   333 Pfingsten Rd.
   Northbrook, IL 60062
   312-272-8800
1.5 APPLICABLE CODES AND REGULATIONS

1.5.1 GENERAL APPLICABILITY OF CODES, REGULATIONS, AND STANDARDS

A. 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.

B. 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.

C. 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.

1.5.2 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) including respiratory protection including 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 requirements related to failure to comply with the regulations applicable to the work.

1.5.3 FEDERAL REQUIREMENTS

Federal requirements which govern of 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 1910 Subpart I - Personal Protective Equipment
   3. Title 29 CFR 1910.134 - Respiratory Protection
   4. Title 29 CFR 1926 - Construction Industry Standards
   5. Title 29 CFR 1910.1020 - Access to Employee Exposure and Medical Records
   7. Title 29 CFR 1910 Subpart K - Medical and First Aid

B. Environmental Protection Agency (EPA):
   2. 40 CFR 763.80 - Asbestos Hazard Emergency Response Act (AHERA)

C. Department of Transportation (DOT)
   Title 49 CFR 100 - 185 - Transportation
1.5.4 STATE REQUIREMENTS
Comply with all State requirements that apply to the asbestos abatement work, disposal, clearance, etc.

1.5.5 LOCAL REQUIREMENTS
Comply with local requirements if more stringent than federal or state standards.

1.5.6 STANDARDS
A. Standards which govern asbestos abatement activities include, but are not limited to, the following:
B. Standards which govern encapsulation work include, but are not limited to the following:
   1. American Society for Testing and Materials (ASTM)
C. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:

1.5.7 EPA GUIDANCE DOCUMENTS
A. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference. EPA publications can be ordered from (800) 424-9065.
   B. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024
   C. Asbestos Waste Management Guidance EPA 530-SW-85-007
   D. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001
   E. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990

1.5.8 NOTICES
A. State and Local agencies: Send written notification as required by state and local regulations including the local fire department prior to beginning any work on ACM as follows:
B. 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.

1.5.9 PERMITS/LICENSES
A. 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.
1.5.10 POSTING AND FILING OF REGULATIONS

A. 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 copy in the Contractor's office.

1.5.11 VA RESPONSIBILITIES

Prior to commencement of work:

A. 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.**

B. 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.

1.5.12 EMERGENCY ACTION PLAN AND ARRANGEMENTS

A. 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 1910.38 (a);(b).

B. 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.

C. 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.

D. 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.

E. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.

1. For non-life-threatening situations - employees injured or otherwise incapacitated shall decontaminate following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.

2. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, remove them from the regulated area, and secure proper medical treatment.
F. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.

G. 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.

H. 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.

1.5.13 PRE-CONSTRUCTION MEETING

Prior to commencing the work, the Contractor shall meet with the VA Certified Industrial Hygienist (VPCIH) 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 all applicable State and Local requirements.

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);
   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.


1.6 PROJECT COORDINATION

The following are the minimum administrative and supervisory personnel necessary for coordination of the work.
1.6.1 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; social security number; qualifications; accreditation card with color picture; 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 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 states; 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 developed at least one complete standard operating procedure for asbestos abatement; has trained abatement personnel for three (3) years; 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.
All personnel should be in compliance with OSHA construction safety training as applicable and submit certification.

1.7 RESPIRATORY PROTECTION

1.7.1 GENERAL - RESPIRATORY PROTECTION PROGRAM

The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with the January 8, 1998 OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.Subpart I;134. ANSI Standard Z88.2-1992 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)(1)(i - ix) - Respiratory Protection Program.

1.7.2 RESPIRATORY PROTECTION PROGRAM COORDINATOR

The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years 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.

1.7.3 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 for reference by employees or authorized visitors.

1.7.4 MINIMUM RESPIRATORY PROTECTION

Minimum respiratory protection shall be a full face powered air purifying respirator when fiber levels are maintained consistently at or below 0.5 f/cc. A higher level of respiratory protection may be provided or required, depending on fiber levels. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h); Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

1.7.5 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.

1.7.6 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.
1.7.7 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 wearing a respirator inside the regulated area until resolution of the problem.

1.7.8 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.

1.7.9 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-560-0PTS-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

1.8.1 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.

1.8.2 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 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.

1.8.3 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.
1.8.4 DECONTAMINATION PROCEDURE

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

A. When exiting the regulated area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.

B. 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:
1. Thoroughly wet body including hair and face. If using a PAPR hold blower above head to keep filters dry.
2. 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.
3. 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.

C. 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!)

D. Shower and wash body completely with soap and water. Rinse thoroughly.
E. Rinse shower room walls and floor to drain prior to exiting.
F. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

1.8.5 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

1.9.1 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.

1.9.2 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.

1.9.3 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.

1.9.4 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 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. 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 can enter or exit the PDF during her stay in the PDF.

2. Shower Room: The Competent Person shall assure that the shower room is a completely water tight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using air tight walls made from at least 3 layers of 6 mil opaque fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Waste water will be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters will be changed a minimum of daily or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste.

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

4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of 2 layers of 6 mil opaque fire retardant poly.
1.9.5 WASTE/EQUIPMENT DECONTAMINATION FACILITY (W/EDF)

The Competent Person shall provide an W/EDF consisting of a wash room, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:

1. 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.

2. 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" x 4") 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.

3. 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" x 4") wood framing 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.

4. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 x 4 wood framing 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.

5. 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.
1.9.6 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. These personnel will not be required to wear PPE. 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

2.1.1 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.

A. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).

B. 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.

C. 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.

D. 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.

E. 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.
F. 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 furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or other effective procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.

G. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6 mil fire retardant poly.

H. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.

I. 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.

J. 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).

K. 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.

L. The VA shall be provided an advance copy of the MSDS 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.

M. 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.

N. 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

2.2.1 GENERAL

A. 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 to satisfy OSHA requirements. Additional inspection and testing requirements are also indicated in other parts of this specification.

B. 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.

C. 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 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.

2.2.2 SCOPE OF SERVICES OF THE VPIH/CIH CONSULTANT

A. 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:
1. Task 1: Establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
2. Task 2: Perform continuous 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.
3. 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.
4. Task 4: Provide support to the VA representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.
5. 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.
6. Task 6: Issue certificate of decontamination for each regulated area and project report.

B. 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.

C. The monitoring and inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

2.2.3 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 Analytic Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor or Abatement Worker and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and area samples as well as responsibility for documentation on substantially similar projects in size and scope. The analytic 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 air personal 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.

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

The Contractor shall have 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:

A. Minimum Personnel Qualifications
B. Emergency Action Plan/Contingency Plans and Arrangements
C. Security and Safety Procedures
D. Respiratory Protection/Personal Protective Equipment Program and Training
E. Medical Surveillance Program and Recordkeeping
F. Regulated Area Requirements - Containment Barriers/Isolation of Regulated Area
G. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF)
H. Negative Pressure Systems Requirements
I. Monitoring, Inspections, and Testing
J. Removal Procedures for ACM
K. Removal of Contaminated Soil (if applicable)
L. Encapsulation Procedures for ACM
M. Disposal of ACM waste/equipment
N. Regulated Area Decontamination/Clean-up
O. Regulated Area Visual and Air Clearance
P. Project Completion/Closeout

2.4 SUBMITTALS

2.4.1 PRE-START MEETING SUBMITTALS

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, 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 and of the company's officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.

I. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses.
Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and 29 CFR 1910.20 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; number of workers trained; samples of training materials; samples of AHAPs developed; medical opinion; and current respirator fit test.

2. Competent Person(s)/Supervisor(s): Number; names; 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; 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 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 MSDS and application instructions.

2.4.2 SUBMITTALS DURING ABATEMENT

A. 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 breaching, 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 VPIH/CIH.

B. 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.

1. Removal of any poly barriers.
2. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant.
4. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's representative on a weekly basis.

2.4.3 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

2.5.1 TYPES OF ENCAPSULANTS

A. The following four types of encapsulants, if used, must comply with performance requirements as stated in paragraph 2.6.2:
1. Removal encapsulant - used as a wetting agent to remove ACM.
2. Bridging encapsulant - provides a tough, durable coating on ACM.
3. Penetrating encapsulant - penetrates/encapsulates ACM at least 13 mm (1/2").
4. Lockdown encapsulant - seals microscopic fibers on surfaces after ACM removal.

2.5.2 PERFORMANCE REQUIREMENTS

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.
3. ASTM C732: Accelerated Aging Test; Life Expectancy - 20 years.
4. ASTM E96: Permeability - minimum 0.4 perms.
B. Bridging/Penetrating Encapsulants:
1. ASTM E736: Cohesion/Adhesion Test - 24 kPa (50 lbs/ft²).
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 lbs/ft²) (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 off-gassing any noxious vapors during application.

2.5.3 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

3.1.1 SITE SECURITY
A. 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.

B. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent Person shall immediately require any unauthorized person to leave the regulated area and then notify the VA Contracting Officer or VA Representative using the most expeditious means.

C. 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.

D. Access to the regulated area shall be through a single decontamination unit. 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 fire retardant 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.

E. 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.

F. 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.

G. The regulated area shall be locked during non-working hours and secured by VA Representative or Competent Person. The VA Police should be informed of asbestos abatement regulated areas to provide security checks during facility rounds and emergency response.
3.1.2. SIGNAGE AND POWER MANAGEMENT

A. Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area where airborne concentrations of asbestos may exceed the PEL. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.

B. 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.

C. 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 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.

3.1.3 NEGATIVE PRESSURE FILTRATION SYSTEM

The Contractor shall provide enough HEPA negative air machines to effect $> - 0.02$ WCG pressure. The Competent Person shall determine the number of units needed for the regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to effect $> - 0.02$ WCG pressure. Provide a standby unit in the event of machine failure and/or emergency in an adjacent area. NIOSH has done extensive studies and has determined that negative air machines typically operate at $\sim 50\%$ efficiency. The contractor shall consider this in their determination of number of units needed to provide $> - 0.02$ WCG pressure. 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" pressure drop across the filters.

3.1.3.1 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.

3.1.3.2 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" 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 CPM 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%. 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 changed by the contractor or documentation when changed and tested by the contractor filters.

3.1.3.3 PRESSURE DIFFERENTIAL

The fully operational negative air system within the regulated area shall continuously maintain a pressure differential of -0.02" water column gauge. 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(e)(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.

3.1.3.4 MONITORING

The pressure differential shall be continuously monitored and recorded between the regulated area and the area outside the regulated area with a monitoring device that incorporates a strip chart recorder. The strip chart recorder shall become part of the project log and shall indicate at least -0.02" water column gauge for the duration of the project.

3.1.3.5 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% of the negative air machines in operation.

3.1.3.6 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.

3.1.3.7 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.

3.1.3.8 DEMONSTRATION OF THE NEGATIVE PRESSURE FILTRATION SYSTEM

The demonstration of the operation of the negative pressure system to the VA shall include, but not be limited to, the following:
A. Plastic barriers and sheeting move lightly in toward the regulated area.
B. Curtains of the decontamination units move in toward regulated area.
C. 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.
D. 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 least -0.02" across every barrier separating the regulated area from the rest of the building. Modify the system as necessary to meet the above requirements.

3.1.3.9 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" water column gauge, for the duration of the work until a final visual clearance and final air clearance has been successfully completed. No negative air units shall be shut down at any time unless authorized by the VA Contracting Officer, verbally and in writing.
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. 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. 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.

D. 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.

3.1.3.10 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 shall be attached to the units.

3.1.4 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA

3.1.4.1 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, 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.

3.1.4.2 PREPARATION PRIOR TO SEALING THE REGULATED AREA

Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects remaining in the regulated area shall be completely covered with 2 layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area.

3.1.4.3 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.
3.1.4.4 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.

3.1.4.5 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"). Seams must overlap at least 1800 mm (6') 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") exterior grade plywood treads held in place with duct tape/glue on the plastic. Do not cover rungs or rails with any isolation materials.

3.1.4.6 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 and at a minimum once per work day.

3.1.4.7 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.

3.1.4.8 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.

3.1.5 SANITARY FACILITIES

The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.

3.1.6 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.

3.1.7 PRE-CLEANING

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.

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.

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 should 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.

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.

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.

3.1.8 PRE-ABATEMENT ACTIVITIES

3.1.8.1 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.

3.1.8.2 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.

3.1.8.3 PRE-ABATEMENT INSPECTIONS AND PREPARATIONS

Before any work begins on the construction of the regulated area, the Contractor will:
A. Conduct a space-by-space inspection with an authorized VA representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.
B. The VA Representative, the Contractor, and the VPIH/CIH must be aware of AEQA 10-95 indicating the failure to identify asbestos in the areas listed as well as common issues when preparing specifications and contract documents. This is especially critical when demolition is planned, because AHERA surveys are non-destructive, and ACM may remain undetected. A NESHAPS (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; crawlspaces (previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; and steam line trench coverings.
C. Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination. SPEC WRITER NOTE: Indicate responsible party in charge of decontamination, removal and relocation of regulated area furnishings.
D. If present and required, remove and dispose of carpeting from floors in the regulated area.
E. Inspect existing firestopping in the regulated area. Correct as needed.

3.2 REMOVAL OF ACM

3.2.1 WETTING ACM

A. 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.
B. Amended Water: Provide water to which a surfactant has been added shall be used 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 one ounce of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with 5 gallons (19L) of water.

C. Removal Encapsulant: When authorized by VA, 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 removal.

3.2.2 SECONDARY BARRIER AND WALKWAYS

A. Install as a drop cloth a 6 mil poly sheet at the beginning of each work shift where removal is to be done during that shift. Completely cover floors and any walls within 10 feet (3 meters) of the area where work is to be done. Secure the secondary barrier with duct tape to prevent it from moving or debris from getting behind it. Remove the secondary barrier at the end of the shift or as work in the area is completed. Keep residue on the secondary barrier wetted. When removing, fold inward to prevent spillage and place in a disposal bag.

B. Install walkways using 6 mil black poly between the regulated area and the decontamination facilities (PDF and W/EDF) to protect the primary layers from contamination and damage. Install the walkways at the beginning of each shift and remove at the end of each shift.

3.2.3 WET REMOVAL OF ACM

A. 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 (at a minimum two hours) 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.

B. If ACM does not wet well with amended water due to composition, coating or jacketing, remove as follows:
   1. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.
   2. 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.
   3. 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 (6M), 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.

4. 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' x 6' (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.

5. 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" from the point it contacts the ACM.

3.2.4 WET REMOVAL OF AMOSITE

A. 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.

B. 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 located no more than 600 mm (2') 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') square flared end piece on the intake of the duct. Support the duct horizontally at a point 600 mm (2') below the work to effect capture. One person in the crew shall be assigned to operate the duct collection system on a continual basis.

C. 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 VPH/CIH and VA Contracting Officer. 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.
3.2.5 REMOVAL OF ACM/DIRT FLOORS AND OTHER SPECIAL PROCEDURES

A. 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.

Options for abatement of asbestos contaminated soil include: Removal of top 6 inches of soil; encapsulated 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.

1. 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 special vacuum truck equipped with HEPA filtration to remove soil.

2. Enclosure of ACS using a concrete layer of 4” 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.

B. Crawlspace/Pipe Tunnels:
When working in crawlspace 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 and 3.6.5.

Options for abatement of asbestos contaminated soil include: Removal of top 6 inches of soil; encapsulated 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

3.3.1 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.

3.3.2 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 MSDS for the material.

3.3.3 WORKER PROTECTION
Before beginning work with any material for which an MSDS 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 used in
addition to the HEPA filter when an organic solvent based encapsulant
is used. The CPIH/CIH shall be responsible for provision of adequate
respiratory protection. Note: Flammable and combustible encapsulants
shall not be used, unless authorized in writing by the VA.

3.3.4 ENCAPSULATION OF SCRATCH COAT PLASTER OR PIPING
A. Apply two coats of lockdown encapsulant to the scratch coat plaster or
pipings 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.
B. 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 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.

3.3.5 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
3.4.1 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
100-185 regulations. Disposal shall be done at an approved landfill. Disposal of non-friable ACM shall be done in accordance with applicable regulations.

3.4.2 PROCEDURES
A. The VA must be notified at least 24 hours in advance of any waste removed from the containment.
B. 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. 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.
C. 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/or HEPA vacuuming before being placed in the second waste bag and sealed, which then must also be wet wiped or HEPA vacuumed.
D. 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
3.5.1 GENERAL
A. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.
B. 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.
C. 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.
3.5.2 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.

3.5.3 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.

3.5.4 PRE-DECONTAMINATION CONDITIONS

A. 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.

B. At the start of decontamination, the following shall be in place:
   1. Primary barriers consisting of 2 layers of 6 mil poly on the floor and 4 mil poly on the walls.
   2. 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.
   4. Decontamination facilities for personnel and equipment in operating condition and the negative pressure system in operation.

3.5.5 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/or HEPA vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications. The negative pressure system shall remain in operation during this time. Additional cleaning(s) may be needed as determined by the CPIH/VPIH/CIH.

3.5.6 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.

3.5.7 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

3.6.1 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.

3.6.2 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 cost to the VA. Dust/material samples may be collected and analyzed at no 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.

3.6.3 FINAL AIR CLEARANCE TESTING

A. 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 one field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA 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.

B. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

3.6.4 FINAL AIR CLEARANCE PROCEDURES

A. 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, or 70 AHERA structures per square millimeter (s/mm²) by AHERA TEM.

B. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures:

1. Fibers Counted: "Fibers" referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.

2. Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques except where soil is not encapsulated or enclosed. Samples will be collected on 0.8μ MCE filters for PCM analysis and 0.45μ Polycarbonate filters for TEM. A minimum of 1200 Liters of using calibrated pumps shall be collected for clearance samples. Before pumps are started, initiate aggressive air mixing sampling as detailed in 40 CFR 763 Subpart E (AHERA)
Appendix A (III)(B)(7)(d). Air samples will be collected in areas subject to normal air circulation away from corners, obstructed locations, and locations near windows, doors, or vents. After air sampling pumps have been shut off, circulating fans shall be shut off. The negative pressure system shall continue to operate.

3. Final clearance for soil that is not encapsulated, samples will be collected on 0.8µ MCE filters for PCM analysis and 0.45µ Polycarbonate filters for TEM. A minimum of 1200 Liters of using calibrated pumps shall be collected for 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.

4. Random 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 SF of soil – 3 samples; >1000 to <5000 SF of soil – 5 samples; and >5000 SF 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% 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% asbestos, the areas shall be re-cleaned until the sample results are <1%.

3.6.5 CLEARANCE SAMPLING USING PCM – LESS THAN 260LF/160SF:
A. The VPIH/CIH will perform clearance samples as indicated by the specification.
B. The NIOSH 7400 PCM method will be used for clearance sampling with a minimum collection volume of 1200 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.
C. Random 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 SF of soil – 3 samples; >1000 to <5000 SF of soil – 5 samples; and >5000 SF 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% 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% asbestos, the areas shall be re-cleaned until the sample results are <1%.

3.6.6 CLEARANCE SAMPLING USING TEM – EQUAL TO OR MORE THAN 260LF/160SF: TEM
A. Clearance requires 13 samples be collected; 5 inside the regulated area; 5 outside the regulated area; and 3 field blanks.
B. 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.

3.6.7 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 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.

3.6.8 LABORATORY TESTING OF TEM SAMPLES

Samples shall be sent by the VPIH/CIH to a NIST 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 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.

3.6.9 LABORATORY TESTING OF BULK SAMPLES

Samples shall be sent by the VPIH/CIH or CPIH/CIH to a NIST accredited laboratory for analysis by PLM. The laboratory shall be successfully participating in the NIST Bulk Asbestos Analysis (PLM) program. Verbal/faxed results from the laboratory shall be available within 24 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.

3.7 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

3.7.1 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:
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.

3.7.2 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.

3.7.3 WORK SHIFTS

All work shall 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.

3.7.4 RE-INSULATION

If required as part of the contract, replace all asbestos containing insulation/fire-proofing with suitable non-asbestos material. Provide MSDS’s for all replacement materials in advance of installation for VA
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.

crih/cih signature/date: ______________________

crih/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 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: __________________________
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 _______

Abatement Contractor Competent Person(s) __________________________ Date _______

- - END- - - -
SECTION 02 83 33.13
LEAD-BASED PAINT REMOVAL AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Removing and disposal of lead-based paint encountered at demolition work locations.

1.2 RELATED REQUIREMENTS
A. Hazardous Material Abatement: Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
B. Demolition Disturbing Lead-Based Paint: Section 02 41 00, DEMOLITION.

1.3 DEFINITIONS
A. Action Level: Employee exposure, without regard to use of respirator, to lead airborne concentration of 30 micrograms per cubic meter (0.03 parts per million) of air averaged over 8-hour period. As used in this section, "30 micrograms per cubic meter of air (0.03 parts per million)" refers to action level.
B. Area Monitoring: Sampling of lead concentrations within lead control area and inside physical boundaries which are representative of airborne lead concentrations which may reach breathing zone of personnel potentially exposed to lead.
C. Breathing Zone: Area within hemisphere, forward of shoulders, with 150 mm to 225 mm (6 to 9 inches) radius and center at nose or mouth of employee.
D. Certified Industrial Hygienist (CIH): As used in this section, refers to an Industrial Hygienist employed by Contractor.
E. Change Rooms and Shower Facilities: Rooms within designated physical boundary around lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross-contamination.
F. Competent Person: Person capable of identifying lead hazards in work area and authorized by contractor to take corrective action.
G. Decontamination Room: Room for removal of contaminated personal protective equipment (PPE).
H. Eight-Hour Time Weighted Average (TWA): Airborne concentration of lead averaged over 8-hour workday to which an employee is exposed.
I. High Efficiency Particulate Air (HEPA) Filter Equipment:
HEPA filtered vacuuming equipment with UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. HEPA filter means 99.97 percent efficient against 0.3 micron (0.012 mil) size particles.

J. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.

K. Lead Control Area: Enclosed area or structure with full containment to prevent spreading lead dust, paint chips, and debris from lead-based paint removal operations. Lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.

L. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter (0.05 parts per million) of air as 8-hour time weighted average as determined by 29 CFR Part 1910.1025. When employee is exposed for more than 8 hours per work day, determine PEL by following formula. PEL micrograms/cubic meter (parts per million) of air = 400/No. of hrs. worked per day.

M. Personnel Monitoring: Sampling of lead concentrations within employee breathing zone to determine 8-hour time weighted average concentration according to 29 CFR Part 1910.1025. Take samples representative of employee's work tasks.

N. Physical Boundary: Area physically roped or partitioned off around enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean same as "outside lead control area."

1.4 APPLICABLE PUBLICATIONS
A. Comply with references to extent specified in this section.

B. American National Standards Institute (ANSI):

   1. 29 CFR Part 1910 - Occupational Safety and Health Standards.
   2. 29 CFR Part 1926 - Safety and Health Regulations for Construction.
D. Underwriters Laboratories (UL):
   1. 586-09 - High-Efficiency, Particulate, Air Filter Units.

1.5 PRE-REMOVAL MEETINGS
A. Conduct pre-removal meeting at project site minimum 30 days before beginning Work of this section.
   1. Required Participants:
      a. Contracting Officer's Representative.
      b. Certified Industrial Hygienist.
      c. Contractor.
      d. Paint removal contractor.
      e. Other installers responsible for finishing resulting surfaces.
   2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
      a. Respiratory protection program.
      b. Hazard communication program.
      c. Hazardous waste management plan.
      d. Safety and health regulation compliance.
      e. Employee training.
      f. Removal schedule.
      g. Removal sequence.
      h. Preparatory work.
      i. Protection before, during, and after removal.
      j. Removal.
      k. Inspecting and testing.
      l. Other items affecting successful completion.
   3. Document and distribute meeting minutes to participants to record decisions affecting installation.
1.6 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
   1. Description of each product.
      a. Paint removal products.
      b. Vacuum filters.
      c. Respirators.
   2. Safety data sheet for each paint removal product.
   3. Installation instructions.
      a. Paint removal products.

C. Test Reports: Submit testing laboratory reports.
   1. Submit air monitoring results within three working days, signed by testing laboratory employee performing air monitoring, employee analyzing sample, and CIH.

D. Certificates: Certify completed training.
   1. Submit certificate for each employee signed and dated by CIH and employee stating employee was trained.

E. Qualifications: Substantiate qualifications comply with specifications.
   1. Paint removal contractor.
   2. Testing laboratory.
      a. Name, address, and telephone number.
      b. Current evidence of participation in NIOSH PAT Program.
      c. Copy of current AIHA accreditation certificate.
   3. Industrial hygienist.
      a. Name, address, and telephone number.
      b. Resume showing previous experience.
      c. Copy of current ABIH CIH certification.
   4. Paint disposal facility.
      a. Name, address, and telephone number.
      b. Current license or authorization to receive and dispose lead contaminated waste.

F. Record Documents:
   1. Completed and signed hazardous waste manifest from waste transporter.
   2. Paint disposal facility receipts and disposition reports.
   3. Certification of medical examinations.
   4. Employee training certification.
1.7 QUALITY ASSURANCE

A. Safety and Health Regulation Compliance:
   1. Comply with laws, ordinances, rules, and regulations of federal, state, and local authorities having jurisdiction regarding removing, handling, storing, transporting, and disposing lead waste materials.
      b. Notify Contracting Officer's Representative and request resolution of conflicts between regulations and specified requirements before starting work.
   2. Comply with the local laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing lead-contaminated materials:

B. Paint Removal Contractor: Experienced contractor, registered or licensed by applicable state agency regulating lead-based paint removal.

C. Testing Laboratory: State certified independent testing laboratory experienced in airborne lead monitoring, testing, and reporting.
   1. Successful participant in NIOSH Proficiency Analytical Testing (PAT) Program within prior 12 months.
   2. Accredited by American Industrial Hygiene Association (AIHA).

D. Certified Industrial Hygienist: Certified as CIH by American Board of Industrial Hygiene in comprehensive practice and responsible for:
   1. Certify Training.
   2. Review and approve lead-based paint removal plan for conformance to applicable referenced standards.
   3. Inspect lead-based paint removal work for conformance with approved plan.
   4. Direct monitoring.
   5. Ensure work is performed according to specifications.
   6. Ensure personnel and environment hazardous exposures are adequately controlled.

E. Paint Disposal Facility: State certified disposal facility qualified to receive and dispose lead-based paint.

F. Lead-based Paint Removal Plan:
   1. Submit detailed, site-specific plan describing lead-based paint removal procedures.
2. Include sketch showing location, size, and details of lead control areas, decontamination rooms, change rooms, shower facilities, and mechanical ventilation system.

3. Include eating, drinking, and restroom procedures, interface of trades, work sequencing, collected wastewater and paint debris disposal plan, air sampling plan, respirators, protective equipment, and detailed description of containment methods ensuring airborne lead concentrations do not exceed action level outside lead control area.
   a. Eating, drinking, and smoking are not acceptable within lead control area.

4. Include air sampling, training and strategy, sampling methodology, frequency, duration, and qualifications of air monitoring personnel.

   1. Provide each employee negative pressure or other appropriate respirator.
      a. Test fit each employee's respirator at initial fitting and maximum 6 month intervals, as required by 29 CFR Part 1926.62.


I. Hazardous Waste Management Plan: Establish and implement plan according to applicable requirements of Federal, State, and local hazardous waste regulations including the following:
   1. Identification of hazardous wastes associated with work.
   2. Estimated quantities of generated and disposed waste.
   3. Names and qualifications of each contractor transporting, storing, treating, and disposing wastes. Include facility location and 24-hour point of contact. Provide two copies of // EPA // state // and // local // hazardous waste // permit applications // permits // and // EPA Identification numbers //.
   4. Names and qualifications (experience and training) of personnel working on-site with hazardous wastes.
   5. List of required waste handling equipment including cleaning, volume reduction, and transport equipment.
   6. Spill prevention, containment, and cleanup contingency implementation measures.
7. Work plan and schedule for waste containment, removal, and disposal with daily waste cleaned up and containerization.

1.8 WARRANTY
A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PAINT REMOVAL PRODUCTS
A. Chemical Stripper: Biodegradable, non-toxic, capable of removing existing paint layers in one application, and acceptable to CIH.

2.2 ACCESSORIES
A. Waste Collection Drums: 49 CFR Part 178; Type 1A2, steel, removable head, 200 L (55 gal.) capacity, capable of containing waste without loss.
B. Vacuum Cleaner: HEPA filtered type.
C. Scrapers:
   1. Metal type for use on metal, concrete, and masonry surfaces.
   2. Plastic type for use on wood, plaster, gypsum board, and other surfaces.
D. Rinse Water: Potable.
E. Cleaning Cloths: Cotton.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Before exposure to lead-contaminated dust, provide workers with comprehensive medical examination required by 29 CFR Part 1926.62 (I) (i) and (ii).
   1. Exemption: Examination is not required when employee medical records show last examination required by 29 CFR Part 1926.62(I) was completed within previous 12 months.
B. Maintain complete and accurate employee medical records according to 29 CFR Part 1910.20.
C. Train each employee performing paint removal, disposal, and air sampling operations according to 29 CFR Part 1926.62.
   1. Certify training is completed before employee is permitted to work on project and enter lead control area.
3.2 PREPARATION

A. Protect existing work indicated to remain.
   1. Perform paint removal work without damaging and contaminating adjacent work.
   2. Restore damage and contamination to original condition.
B. Notify Contracting Officer 20 (twenty) days before starting paint removal work.
C. Lead Control Area Requirements:
   1. Establish lead control area by completely enclosing lead-based paint removal work area with containment screens.
   2. Contain removal operations using negative pressure full containment system with minimum one change room and HEPA filtered exhaust.
D. Boundary Requirements: Provide physical boundaries around lead control area by roping off area as required or as designated on drawings or providing curtains, portable partitions or other enclosures to ensure that airborne lead concentrations do not meet or exceed action level outside of lead control area.
E. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems supplying exhausting, and passing through lead control areas. Seal HVAC inlets and outlet within lead control area with 6-mil plastic sheet and tape. Tape seal seams in HVAC components passing through lead control area.
F. Change Room and Shower Facilities: Provide clean change rooms and shower facilities within physical boundary around lead control area according to 29 CFR Part 1926.62.
G. Mechanical Ventilation System:
   1. Provide ventilation system to control personnel exposure to lead according to 29 CFR Part 1926.57.
   2. Design, construct, install, and maintain HEPA filtered fixed local exhaust ventilation system according to ANSI Z9.2 and approved by CIH.
   3. Exhaust ventilation air to exterior wherever possible.
   4. When exhaust ventilation air must be recirculated into work area, provide HEPA filter with reliable back-up filter and controls to monitor lead concentration in return air and to bypass recirculation system automatically when system fails.
H. Personnel Protection: Provide and use required protective clothing and equipment within lead control area.
I. Warning Signs: Provide warning signs complying with 29 CFR Part 1926.62 at lead control area approaches. Locate signs so personnel read signs and take necessary precautions before entering lead control area.

3.3 WORK PROCEDURES
A. Remove lead-based paint according to approved lead-based paint removal plan.
   1. Perform work only in presence of CIH or Industrial Hygienist (IH) Technician under direction of CIH ensuring continuous inspection of work in progress and direction of air monitoring activities.
B. Use procedures and equipment required to limit occupational and environmental lead exposure when lead-based paint is removed according to 29 CFR Part 1926.62.
C. Dispose removed paint and waste according to Environmental Protection Agency (EPA), federal, state, and local requirements.
D. Personnel Exiting Procedures:
   1. When personnel exit lead control area, comply with the following procedures:
      a. Vacuum exposed clothing surfaces.
      b. Remove protective clothing and equipment in decontamination room. Place clothing in approved impermeable disposal bag.
      c. Shower.
      d. Dress in clean clothes before leaving lead control area.
E. Monitoring - General:
   1. Monitor airborne lead concentrations according to 29 CFR Part 1910.1025 by testing laboratory as directed by CIH.
   2. Take personal air monitoring samples on employees anticipated to have greatest exposure risk as determined by CIH. Additionally, take air monitoring samples on minimum 25 percent of work crew or minimum of two employees, whichever is greater, during each work shift.
   3. Submit results of air monitoring samples, signed by CIH, within 24 (twenty-four) hours after taking air samples. Notify Contracting Officer's Representative immediately of lead exposure at or exceeding action level outside of lead control area.
F. Monitoring During Paint Removal:
   1. Perform personal and area monitoring during entire paint removal operation.
   2. Conduct area monitoring at physical boundary daily for each work shift to ensure unprotected personnel are not exposed above action level anytime.
   3. For outdoor operations, take at least one sample on each shift leeward of lead control area. When adjacent areas are contaminated, clean area of contamination and have CIH visually inspect and certify lead contamination is cleaned.
   4. Stop work when outside boundary lead levels meet or exceed action level. Notify Contracting Officer's Representative, immediately.
   5. Correct conditions causing increased lead concentration as directed by CIH.
   6. Review sampling data collected during work stoppage to determine if conditions require additional work method modifications as determined by CIH.
   7. Resume paint removal when approved by CIH.

3.4 LEAD-BASED PAINT REMOVAL
   A. Remove paint within areas indicated on drawings completely exposing substrate. Minimize damage to substrate.
   B. Comply with paint removal processes described lead paint removal plan.
   C. Lead-Based Paint Removal: Select processes for each application to minimize work area lead contamination and waste.

3.5 SUBSTRATE SURFACE PREPARATION
   A. Protect substrates from deterioration and contamination until refinshed.
      1. Protect metal substrates from flash rusting.
   B. Prepare and paint substrates according to Section 09 91 00, PAINTING.

3.6 FIELD QUALITY CONTROL
   A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
   B. Perform sampling and testing for:
      1. Air monitoring.
      2. Lead based paint.

3.7 CLEANING AND DISPOSAL
   A. Cleaning:
1. Maintain lead control area surfaces free of accumulating paint chips and dust. Confine dust, debris, and waste to work area.
2. Vacuum clean work area daily, at end of each shift, and when paint removal operation is complete.

B. CIH Certification: Certify in writing that inside and outside lead control area air monitoring samples are less than action level, employee respiratory protection was adequate, the work was performed according to 29 CFR Part 1926.62, and no visible accumulations of lead-based paint and dust remain on worksite.

1. Do not remove lead control area or roped-off boundary and warning signs before Contracting Officer's Representative's receipt of CIH's certification.
2. Reclean areas showing dust or residual paint chips.

C. Testing: Where indicated and when directed by Contracting Officer's Representative, test lead-based paint residue and used abrasive according to 40 CFR Part 261 for hazardous waste.

D. Waste Collection:

1. Collect lead-contaminated materials including waste, scrap, debris, bags, containers, equipment, and clothing, which may produce airborne lead contamination.
2. Place lead contaminated materials in waste disposal drums. Label each drum identifying waste type according to 49 CFR Part 172 and date waste materials were first put into drum. Obtain and complete the Uniform Hazardous Waste Manifest forms. Comply with land disposal restriction notification requirements required by 40 CFR Part 268:
3. Coordinate temporary storage location on project site with Contracting Officer's Representative.

E. Waste Disposal:

1. Do not store hazardous waste drums in temporary storage location longer than 90 calendar days from drum label date.
2. Remove, transport, and deliver drums to paint disposal facility.
   a. Obtain signed receipt including date, time, quantity, and description of materials received according to 40 CFR Part 262.
   b. Obtain final report of materials disposition after disposal completion.

--- END ---

LEAD-BASED PAINT REMOVAL AND DISPOSAL 02 83 33.13 - 11
PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Equipment pads.

1.2 RELATED REQUIREMENTS
A. Materials Testing and Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.

1.3 APPLICABLE PUBLICATIONS
A. Comply with references to extent specified in this Section.
B. American Concrete Institute (ACI):
   1. 117-15 - Tolerances for Concrete Construction, Materials and Commentary.
   2. 211.1-91(R2009) - Proportions for Normal, Heavyweight, and Mass Concrete.
   3. 211.2-98(R2004) - Selecting Proportions for Structural Lightweight Concrete.
   4. 301/310M-10 - Structural Concrete.
   5. 305.1-14 - Hot Weather Concreting.
   8. 347-04 - Guide to Formwork for Concrete.
C. ASTM International (ASTM):
   1. A996/A996M-15 - Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
   2. C33/C33M-13 - Concrete Aggregates.
   5. C143/C143M-15 - Slump of Hydraulic Cement Concrete.

1.4 SUBMITTALS
A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Manufacturer's Literature and Data:
1. Concrete Mix Design.
2. Air-entraining admixture, chemical admixtures, and curing compounds.
3. Indicate manufacturer's recommendation for each application.

C. Certificates: Certify products comply with specifications.
   a. Each ready mix concrete batch delivered to site.

1.5 DELIVERY
A. Deliver each ready-mixed concrete batch with mix certification in duplicate according to ASTM C94/C94M.

1.6 WARRANTY
A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS
A. Portland Cement: ASTM C150/C150M, Type I or II.
B. Pozzolans:
   1. Fly Ash: ASTM C618, Class C or F including supplementary optional physical requirements.
   2. Slag: ASTM C989/C989M; Grade 80
C. Coarse Aggregate: ASTM C33/C33M.
   1. Size 467 for footings and walls over 300 mm (12 inches) thick.
   2. Size 7 for coarse aggregate for applied topping and metal pan stair fill.
   3. Size 67 for other applications.
D. Fine Aggregate: ASTM C33/C33M.
E. Lightweight Aggregate for Structural Concrete: ASTM C330/C330M, Table 1.
F. Mixing Water: Fresh, clean, and potable.
H. Chemical Admixtures: ASTM C494/C494M.
I. Reinforcing Steel: ASTM A615/A615M or ASTM A996/A996M, deformed. See Structural Drawings for grade.
J. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer, of grade or type suitable to obtain type of finish specified.
   1. Plywood: Exterior grade, free of defects and patches on contact surface.
   2. Lumber: Sound, grade-marked, S4S stress graded softwood.
   3. Form coating: As recommended by Contractor.
K. Grout, Non-Shrinking: Premixed ferrous or non-ferrous. Grout to show no settlement or vertical drying shrinkage at 3 days. Compressive strength for grout, at least 18 MPa (2500 psi) at 3 days and 35 MPa (5000 psi) at 28 days.

2.2 ACCESSORIES
A. Bonding Agent: ASTM C 1059/C 1059M, Type II.
B. Structural Adhesive: ASTM C 881, 2-component material suitable for use on dry or damp surfaces. Provide material Type, Grade, and Class to suit Project requirements.

2.3 CONCRETE MIXES
A. Design concrete mixes according to ASTM C 94/C94M, Option C.
B. Compressive strength at 28 days: minimum 30 MPa (4,000 psi).
C. Submit mix design and results of compression tests to the Contracting Officer for his evaluation. Identify all materials, including admixtures, making-up the concrete.
D. Maximum Slump for Vibrated Concrete: 100 mm (4 inches) tested according to ASTM C 143.
E. Cement and Water Factor (See Table I):

<table>
<thead>
<tr>
<th>Concrete: Strength</th>
<th>Non-Air-Entrained</th>
<th>Air-Entrained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. 28 Day Comp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Str. MPa (psi)</td>
<td>Min. Cement kg/cu. m</td>
<td>Max. Water Cement Ratio</td>
</tr>
<tr>
<td>35 (5000)1,3</td>
<td>375 (630)</td>
<td>0.45</td>
</tr>
<tr>
<td>30 (4000)1,3</td>
<td>325 (550)</td>
<td>0.55</td>
</tr>
<tr>
<td>25 (3000)1,3</td>
<td>280 (470)</td>
<td>0.65</td>
</tr>
<tr>
<td>25 (3000)1,2</td>
<td>300 (500)</td>
<td>*</td>
</tr>
</tbody>
</table>
TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

<table>
<thead>
<tr>
<th>Min. 28 Day Comp. Str. MPa (psi)</th>
<th>Min. Cement kg/cu. m (lbs./cu. yd.)</th>
<th>Max. Water Cement Ratio</th>
<th>Min. Cement kg/cu. m (lbs./cu. yd.)</th>
<th>Max. Water Cement Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Air-Entrained</td>
<td></td>
<td>Air-Entrained</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Footnotes:
1. If trial mixes are used, achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve a compressive strength 9.7 MPa (1,400 psi) in excess of f’c.
2. Lightweight Structural Concrete: Pump mixes may require higher cement values as specified in ACI 318/318M.
3. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44.
   * Laboratory Determined according to ACI 211.1 for normal weight concrete or ACI 211.2 for lightweight structural concrete.

F. Air-entrainment as specified, and conform with the following for air content table:

TABLE II - TOTAL AIR CONTENT FOR VARIOUS SIZES OF COARSE AGGREGATES

<table>
<thead>
<tr>
<th>Nominal Maximum Size of Coarse Aggregate</th>
<th>Total Air Content, percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mm (3/8 inches)</td>
<td>6 Moderate exposure; 7.5 severe exposure</td>
</tr>
<tr>
<td>13 mm (1/2 inches)</td>
<td>5.5 Moderate exposure; 7 severe exposure</td>
</tr>
<tr>
<td>19 mm (3/4 inches)</td>
<td>5 Moderate exposure; 6 severe exposure</td>
</tr>
<tr>
<td>25 mm (1 inches)</td>
<td>4.5 Moderate exposure; 6 severe exposure</td>
</tr>
<tr>
<td>40 mm (1 1/2 inches)</td>
<td>4.5 Moderate exposure; 5.5 severe exposure</td>
</tr>
</tbody>
</table>

2.4 BATCHING AND MIXING

A. Store, batch, and mix materials according to ASTM C94/C94M.
1. Job-Mixed: Batch mix concrete in stationary mixers as specified in ASTM C94/C94M.
2. Ready-Mixed Concrete: Comply with ASTM C94/C94M, except use of non-agitating equipment for transporting concrete to Site is not acceptable.
3. Mixing Structural Lightweight Concrete: Charge mixer with 2/3 of total mixing water and total aggregate for each batch. Mix ingredients minimum 30 seconds in stationary mixer or minimum 10 revolutions at mixing speed in truck mixer. Add remaining mixing water and other ingredients and continue mixing. Above procedure may be modified as recommended by aggregate producer.
4. When aggregate producer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

PART 3 - EXECUTION

3.1 FORMWORK
A. Installation: Conform to ACI 347. Construct forms to obtain concrete of the shapes, dimensions and profiles indicated, with tight joints.
B. Design and construct forms to prevent bowing-out of forms between supports and to be removable without prying against or otherwise damaging fresh concrete.
C. Construction Tolerances - General: Install and maintain concrete formwork to assure completion of work within specified tolerances.
D. Adjust or replace completed work exceeding specified tolerances before placing concrete.

3.2 REINFORCEMENT
A. Install concrete reinforcement according to ACI 318 and ACI SP-66.
B. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

3.3 PLACING CONCRETE
A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval from Contracting Officer's Representative before placing concrete.
B. Roughen and clean free from laitance, foreign matter, and loose particles before placing new concrete on existing concrete.
1. Blow-out areas with compressed air and immediately coat contact areas with adhesive in compliance with manufacturer's instructions.

C. Place structural concrete according to ACI 301 and ACI 318.

D. Convey concrete from mixer to final place of deposit by method that will prevent segregation or loss of ingredients. Do not deposit, in Work, concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work.

E. Place and consolidate concrete in horizontal layers not exceeding 300 mm (12 inches) in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Continuously vibrate during placement of concrete.

F. Hot Weather Concrete Placement: As recommended by ACI 305.1 to prevent adversely affecting properties and serviceability of hardened concrete.

G. Cold Weather Concrete Placement: As recommended by ACI 306.1, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly.
   1. Do not use calcium chloride without written approval from Contracting Officer's Representative.

3.4 PROTECTION AND CURING

A. Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical damage, and excessive hot or cold temperatures.

B. Curing Methods: Cure concrete with curing compound using wet method with sheets.

C. Formed Concrete Curing: Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.
   1. If forms are removed before 14 days after concrete is cast, install sheet curing materials as specified above.

3.5 FORM REMOVAL

A. Maintain forms in place until concrete is self-supporting, with construction operation loads.

B. Remove fins, laitance and loose material from concrete surfaces when forms are removed. Repair honeycombs, rock pockets, sand runs, spalls, or otherwise damaged surfaces by patching with the same mix as concrete minus the coarse aggregates.
C. Finish to match adjacent surfaces.

3.6 FINISHES

A. Vertical and Overhead Surface Finishes:
   1. Surfaces Concealed in Completed Construction: As-cast; no additional finishing required.
   2. Surfaces Exposed in Unfinished Areas: As-cast; no additional finishing required.
      a. Mechanical rooms.
      b. Electrical rooms.

- - E N D - -
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:
   (None listed)

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):
E84-14..................Surface Burning Characteristics of Building Materials
E814-13a...............Fire Tests of Through-Penetration Fire Stops
E2174-14..............Standard Practice for On-Site Inspection of Installed Firestops
E2393-10a..............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
Annual Issue Fire Resistance Directory
723-10(2008)............Standard for Test for Surface Burning Characteristics of Building Materials
1479-04(R2014).........Fire Tests of Through-Penetration Firestops

E. Intertek Testing Services - Warnock Hersey (ITS-WH):
Annual Issue Certification Listings

F. Environmental Protection Agency (EPA):
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 in.) nominal pipe or 0.01 sq. m (16 sq. in.) 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 in.) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
   3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS:
   A. Provide silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.
   B. Provide mineral fiber filler and bond breaker behind sealant.
   C. Sealants to have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with ASTM E84.
   D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION:
   A. Submit product data and installation instructions, as required by article, submittals, after an on-site examination of areas to receive firestopping.
   B. Examine substrates and conditions with installer present for compliance with requirements for opening configuration, penetrating items,
substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION:
A. Remove dirt, grease, oil, laitance and form-release agents from concrete, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
B. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on each side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.
C. Prime substrates where required by joint firestopping system manufacturer using that manufacturer’s recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
D. Masking Tape: Apply masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

3.3 INSTALLATION:
A. Do not begin firestopping work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
C. Install smoke stopping seals in smoke partitions.

3.4 CLEAN-UP:
A. As work on each floor is completed, remove materials, litter, and debris.
B. Clean up spills of liquid type materials.
C. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
D. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to provide firestopping complying with specified requirements.

3.5 INSPECTIONS AND ACCEPTANCE OF WORK:
A. Do not conceal or enclose firestop assemblies until inspection is complete and approved by the Contracting Officer Representative (COR).
B. Furnish service of approved inspector to inspect firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results. Submit written reports indicating locations of and types of penetrations and type of firestopping used at each location; type is to be recorded by UL listed printed numbers.

- - - 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 this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event.
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:
1. Architectural Elements: Stairs and rails isolated from the basic structure; medical equipment; storage racks; etc.
2. Electrical Elements: Auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; etc.
3. Mechanical Elements: Heating systems; plumbing systems; boiler equipment and components; etc.

1.2 RELATED WORK:
A. Divisions 22-26

1.3 QUALITY CONTROL:
A. Shop-Drawing Preparation:
1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints.
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 Resident Engineer.
2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.
C. Seismic Certification:
In structures assigned to IBC Seismic Design Category C, D, E, or F, permanent equipments and components are to have Special Seismic...
Certification in accordance with requirements of section 13.2.2 of ASCE 7 except for equipment that are considered rugged as listed in section 2.2 OSHPD code application notice CAN No. 2-1708A.5, and shall comply with section 13.2.6 of ASCE 7.

1.4 SUBMITTALS:
A. Submit a coordinated set of equipment anchorage drawings prior to installation.
B. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections.
C. Submit prior to installation, bracing drawings for seismic protection of suspended electrical cables.
D. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.

1.5 APPLICABLE PUBLICATIONS:
A. Applicable industry standard publications are included in this specification.

1.6 REGULATORY REQUIREMENT:
B. Exceptions: The seismic restraint of the following items may be omitted:
   1. Equipment weighing less than 400 pounds, which is supported directly on the floor or roof.
   2. Equipment weighing less than 20 pounds, which is suspended from the roof or floor or hung from a wall.
   3. Gas and medical piping less than 2 ¼ inches inside diameter.
   4. Piping in boiler plants and equipment rooms less than 1 ¼ inches inside diameter.
   5. All other piping less than 2 ¼ inches inside diameter, except for automatic fire suppression systems.
   6. All piping suspended by individual hangers, 12 inches or less in length from the top of pipe to the bottom of the support for the hanger.
   7. All electrical conduits, less than 2 ¼ inches inside diameter.

PART 2 – PRODUCTS

2.1 STEEL:
A. Structural Steel: ASTM A36.
B. Structural Tubing: ASTM A500, Grade B.
D. Steel Pipe: ASTM A53/A53M, Grade B.
2.2 CAST-IN-PLACE CONCRETE:
   A. See Section 03 30 53.

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.

3.2 EQUIPMENT RESTRAINT AND BRACING:
   A. See drawings for equipment to be restrained or braced.

3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING; ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES AND CABLE TRAYS
   A. Support and brace mechanical piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).
   B. 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.

--- END ---
HOT WATER TANK REPLACEMENT
FOR BUILDINGS 1 AND 2

DEPARTMENT OF VETERAN AFFAIRS
MANN-GRANDSTAFF VA MEDICAL CENTER
SPokane, WA

VA PROJECT NO. 668-16-101

November 30, 2016

100% SUBMITTAL

MECHANICAL SPECIFICATIONS

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The Engineer’s seal and signature affixed hereon is all inclusive for the full content for this portion of the document.
PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section shall apply to all sections of Division 22.

B. Definitions:
   1. Exposed: Piping and equipment exposed to view in finished rooms.

C. Abbreviations/Acronyms:
   1. ABS: Acrylonitrile Butadiene Styrene
   2. AC: Alternating Current
   3. ACR: Air Conditioning and Refrigeration
   4. AI: Analog Input
   5. AISI: American Iron and Steel Institute
   6. AO: Analog Output
   7. AWG: American Wire Gauge
   8. BACnet: Building Automation and Control Network
   9. BAg: Silver-Copper-Zinc Brazing Alloy
  10. BAS: Building Automation System
  11. BCuP: Silver-Copper-Phosphorus Brazing Alloy
  12. BSG: Borosilicate Glass Pipe
  13. CDA: Copper Development Association
  14. C: Celsius
  15. CLR: Color
  16. CO: Carbon Monoxide
  17. COR: Contracting Officer’s Representative
  18. CPVC: Chlorinated Polyvinyl Chloride
  19. CR: Chloroprene
  20. CRS: Corrosion Resistant Steel
  21. CWP: Cold Working Pressure
  22. CxA: Commissioning Agent
  23. db(A): Decibels (A weighted)
  24. DDC: Direct Digital Control
  25. DI: Digital Input
  26. DISS: Diameter Index Safety System
  27. DO: Digital Output
  28. DVD: Digital Video Disc
29. DN: Diameter Nominal
30. DWV: Drainage, Waste and Vent
31. ECC: Engineering Control Center
32. EPDM: Ethylene Propylene Diene Monomer
33. EPT: Ethylene Propylene Terpolymer
34. ETO: Ethylene Oxide
35. F: Fahrenheit
36. FAR: Federal Acquisition Regulations
37. FD: Floor Drain
38. FED: Federal
39. FG: Fiberglass
40. FNPT: Female National Pipe Thread
41. FPM: Fluoroelastomer Polymer
42. GPM: Gallons Per Minute
43. HDPE: High Density Polyethylene
44. Hg: Mercury
45. HOA: Hands-Off-Automatic
46. HP: Horsepower
47. HVE: High Volume Evacuation
48. ID: Inside Diameter
49. IPS: Iron Pipe Size
50. Kg: Kilogram
51. kPa: Kilopascal
52. lb: Pound
53. L/s: Liters Per Second
54. L/min: Liters Per Minute
55. MAWP: Maximum Allowable Working Pressure
56. MAX: Maximum
57. MED: Medical
58. m: Meter
59. MFG: Manufacturer
60. mg: Milligram
61. mg/L: Milligrams per Liter
62. ml: Milliliter
63. mm: Millimeter
64. MIN: Minimum
65. NF: Oil Free Dry (Nitrogen)
66. NPTF: National Pipe Thread Female
67. NPS: Nominal Pipe Size
68. NPT: Nominal Pipe Thread
69. OD: Outside Diameter
70. OSD: Open Sight Drain
71. OS&Y: Outside Stem and Yoke
72. OXY: Oxygen
73. PBPU: Prefabricated Bedside Patient Units
74. PH: Power of Hydrogen
75. PLC: Programmable Logic Controllers
76. PP: Polypropylene
77. PPM: Parts per Million
78. PSIG: Pounds per Square Inch
79. PTFE: Polytetrafluoroethylene
80. PVC: Polyvinyl Chloride
81. PVDF: Polyvinylidene Fluoride
82. RAD: Radians
83. RO: Reverse Osmosis
84. RPM: Revolutions Per Minute
85. RTRP: Reinforced Thermosetting Resin Pipe
86. SCFM: Standard Cubic Feet Per Minute
87. SDI: Silt Density Index
88. SPEC: Specification
89. SPS: Sterile Processing Services
90. STD: Standard
91. SUS: Saybolt Universal Second
92. SWP: Steam Working Pressure
93. TEFC: Totally Enclosed Fan-Cooled
94. TFE: Tetrafluoroethylene
95. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
96. THWN: Thermoplastic Heat & Water Resistant Nylon Coated Wire
97. T/P: Temperature and Pressure
98. USDA: U.S. Department of Agriculture
99. V: Volt
100. VAC: Vacuum
101. VA: Veterans Administration
102. VAMC: Veterans Administration Medical Center
103. VAC: Voltage in Alternating Current
104. WAGD: Waste Anesthesia Gas Disposal
105. WOG: Water, Oil, Gas

1.2 RELATED WORK
A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.
E. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
F. Section 03 30 53, CAST-IN-PLACE CONCRETE
G. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
H. Section 22 07 11, PLUMBING INSULATION.
I. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
J. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
K. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

1.3 APPLICABLE PUBLICATIONS
A. The publications listed below shall form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. American Society of Mechanical Engineers (ASME):
   ASME Boiler and Pressure Vessel Code – BPVC Section IX-2013....Welding, Brazing, and Fusing Qualifications
   B31.1-2012..............Power Piping
C. American Society for Testing and Materials (ASTM):
   A36/A36M-2012...........Standard Specification for Carbon Structural Steel
   A575-96(R2013)e1........Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
   E84-2013a.................Standard Test Method for Surface Burning Characteristics of Building Materials
   F1760-01(R2011).........Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
D. International Code Council, (ICC):
   IBC-2012.................International Building Code
   IPC-2012.................International Plumbing Code
E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
SP-69-2003.................Pipe Hangers and Supports - Selection and Application

F. Military Specifications (MIL):
P-21035B.................Paint High Zinc Dust Content, Galvanizing Repair (Metric)

G. National Electrical Manufacturers Association (NEMA):
MG 1-2011................Motors and Generators

H. National Fire Protection Association (NFPA):
51B-2014....................Standard for Fire Prevention During Welding, Cutting and Other Hot Work
54-2012....................National Fuel Gas Code
70-2014....................National Electrical Code (NEC)

I. NSF International (NSF):
5-2012.........................Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment
14-2012.......................Plastic Piping System Components and Related Materials
61-2012.......................Drinking Water System Components – Health Effects
372-2011....................Drinking Water System Components – Lead Content

J. Department of Veterans Affairs (VA):
PG-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 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.
C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements and will fit the space available.
D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

E. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

F. Installing Contractor shall provide lists of previous installations for selected items of equipment. Contact persons who will serve as references, with telephone numbers and e-mail addresses shall be submitted with the references.

G. Manufacturer's Literature and Data: Manufacturer’s literature shall be submitted under the pertinent section rather than under this section.
   1. Electric motor data and variable speed drive data shall be submitted with the driven equipment.
   2. Equipment and materials identification.
   3. Firestopping materials.
   4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
   5. Wall, floor, and ceiling plates.

H. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.

I. Coordination Drawings: Complete consolidated and coordinated layout drawings shall be submitted for all new systems, and for existing systems that are in the same areas. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8 inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show the proposed location and adequate clearance for all equipment, controls, piping, pumps, valves and other items. All valves, trap primer valves, water hammer
arrestors, strainers, and equipment requiring service shall be provided with an access door sized for the complete removal of plumbing device, component, or equipment. Equipment foundations shall not be installed until equipment or piping layout drawings have been approved. Detailed layout drawings shall be provided for all piping systems. In addition, details of the following shall be provided.
1. Mechanical equipment rooms.
2. Interstitial space.
3. Hangers, inserts, supports, and bracing.
4. Pipe sleeves.
5. Equipment penetrations of floors, walls, ceilings, or roofs.

J. 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. Include complete list indicating all components of the systems with diagrams of the internal wiring for each item of equipment.
2. Include listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided. The listing shall include belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

K. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

L. 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. Products Criteria:
1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture, supply and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least 5 years.
2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shutdown of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, compressors, water heaters, critical instrumentation, computer workstation and programming shall be submitted for project record and inserted into the operations and maintenance manual.

3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.

4. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Contracting Officers Representative (COR).

5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.

6. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

8. Asbestos products or equipment or materials containing asbestos shall not be used.

9. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA
recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:

1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".

2. Comply with provisions of ASME B31 series "Code for Pressure Piping".

3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

4. All welds shall be stamped according to the provisions of the American Welding Society.

C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

D. Execution (Installation, Construction) Quality:

1. All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents shall be referred to the COR for resolution. Printed copies or electronic files of manufacturer's installation instructions shall be provided to the COR at least 10 working days prior to commencing installation of any item.

2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to
commencing installation work, refer conflicts between this requirement and contract documents to COR for resolution.

3. Complete layout drawings shall be required by Paragraph, SUBMITTALS. Construction work shall not start on any system until the layout drawings have been approved by VA.

4. Installer Qualifications: Installer shall be licensed and shall provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade.

5. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or additional time to the Government.

E. Guaranty: Warranty of Construction, FAR clause 52.246-21.

F. Plumbing Systems: IPC, International Plumbing Code. Unless otherwise required herein, perform plumbing work in accordance with the latest version of the IPC. For IPC codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word “should” shall be interpreted as “shall”. Reference to the “code official” or “owner” shall be interpreted to mean the COR.

G. Cleanliness of Piping and Equipment Systems:
   1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
   2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
   3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Government. All piping shall be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.
   4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:
   1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and
material. The Contractor is solely responsible for the protection of such equipment and material against any damage.

2. Damaged equipment shall be replaced with an identical unit as determined and directed by the COR. Such replacement shall be at no additional cost or additional time to the Government.

3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.

4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be 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 on Auto-Cad version 2015 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 a certification that all results of tests were within limits specified.

**PART 2 - PRODUCTS**

2.1 MATERIALS FOR VARIOUS SERVICES

A. Plastic pipe, fittings and solvent cement shall meet NSF 14 and shall bear the NSF seal "NSF-PW". Polypropylene pipe and fittings shall comply with NSF 14 and NSF 61. Solder or flux containing lead shall not be used with copper pipe.

B. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF 61 or NSF 372.

C. In-line devices such as water meters, building valves, check valves, stops, valves, fittings, tanks and backflow preventers shall comply with NSF 61 and NSF 372.

2.2 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.

2. Constituent parts that are alike shall be products of a single manufacturer.

3. Components shall be compatible with each other and with the total assembly for intended service.

4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly at no additional cost or time to the Government.

C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, shall be the same make and model.
2.3 COMPATIBILITY OF RELATED EQUIPMENT
A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.4 SAFETY GUARDS
A. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall 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 shall have moving parts protected from personal injury.

2.5 LIFTING ATTACHMENTS
A. Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.6 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING
A. All material and equipment furnished and installation methods used shall conform to the requirements of Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT; Section 26 29 11, MOTOR CONTROLLERS; and, Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems shall be provided. Premium efficient motors shall be provided. Unless otherwise specified for a particular application, electric motors shall 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 without additional cost or time to the Government.
2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71° C (160° F) shall 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, shall be NFPA 70 designation THWN.
   c. Shielded conductors or wiring in separate conduits for all instrumentation and control systems shall be provided where recommended by manufacturer of equipment.

4. Motor sizes shall be selected so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.

5. Motors utilized with variable frequency drives shall be rated “inverter-ready” per NEMA Standard, MG1.

C. Motor Efficiency and Power Factor: All motors, when specified as “high efficiency or Premium Efficiency” by the project specifications on driven equipment, shall conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT, with no consideration of annual service hours. Motor manufacturers generally define these efficiency requirements as “NEMA premium efficient” and the requirements generally exceed those of the Energy Policy Act (EPACT), revised 2005. Motors not specified as “high efficiency or premium efficient” shall comply with EPACT.

D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal pumps may be split phase or permanent split capacitor (PSC).

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. A time delay (20 seconds minimum) relay shall be provided for switching from high to low speed.

F. Rating: Rating shall 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 shall not exceed nameplate rating without service factor.

G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame shall be measured at the time of final inspection.
2.7 VARIABLE SPEED MOTOR CONTROLLERS

A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, MOTOR CONTROLLERS for specifications.

B. The combination of controller and motor shall be provided by the respective pump manufacturer, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. pumps, shall be product of a single manufacturer.

C. Motors shall be premium efficient type, "inverter duty", and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor sheaves shall be fixed pitch.

D. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system.

2.8 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on 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 shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, etc. shall 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 shall 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 shall be provided with valve tags and listed on a valve list (Fixture stops not included).

2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gage, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.

3. Valve lists: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. An additional copy of the valve list shall be mounted in picture frames for mounting to a wall. COR shall instruct contractor where frames shall be mounted.

4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided in the 3-ring binder notebook. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling or access door.

2.9 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) requirements, or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in the state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the COR in all cases. See the above specifications for lateral force design requirements.
B. Type Numbers Specified: For materials, design, manufacture, selection, application, and installation refer to MSS SP-58. For selection and application refer to MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.

C. For Attachment to Concrete Construction:
   1. Concrete insert: Type 18, MSS SP-58.
   2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
   3. Power-driven fasteneners: 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. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

F. 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 gage), 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.

G. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium
silicate shield at all other types of supports and hangers including those for insulated piping.

1. General Types (MSS SP-58):
   a. Standard clevis hanger: Type 1; provide locknut.
   b. Riser clamps: Type 8.
   c. Wall brackets: Types 31, 32 or 33.
   d. Roller supports: Type 41, 43, 44 and 46.
   e. Saddle support: Type 36, 37 or 38.
   f. Turnbuckle: Types 13 or 15.
   g. U-bolt clamp: Type 24.
   h. Copper Tube:
      1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, copper-coated, plastic coated or taped with isolation tape to prevent electrolysis.
      2) For vertical runs use epoxy painted, copper-coated or plastic coated riser clamps.
      3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
      4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
   i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one 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 gage) minimum.

H. Pre-insulated Calcium Silicate Shields:

1. Provide 360 degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.

2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.

3. Shield thickness shall match the pipe insulation.

4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.

   a. Shields for supporting cold water shall have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal.

   b. The insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS SP-69. To support the load, the shields shall have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, trapeze hangers, roller supports or flat surfaces.

2.12 TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the COR.

D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials shall be utilized when possible.
2.13 ASBESTOS

A. Materials containing asbestos are not permitted.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.

B. Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.

C. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, but not limited to: all equipment items, valves, backflow preventers, filters, strainers, transmitters, sensors, meters and control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown on the drawings shall not be changed nor reduced.

D. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.

E. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

F. Cutting Holes:

1. Holes shall be located to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.

2. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.

3. Holes through concrete and masonry shall be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer
type drill will not be allowed, except as permitted by COR where
working area space is limited.

G. Minor Piping: Generally, small diameter pipe runs from drips and
drains, water cooling, and other services are not shown but must be
provided.

H. Protection and Cleaning:
1. Equipment and materials shall be carefully handled, properly stored,
and adequately protected to prevent damage before and during
installation, in accordance with the manufacturer's recommendations
and as approved by the COR. Damaged or defective items in the
opinion of the COR, shall be replaced at no additional cost or time
to the Government.

2. Protect all finished parts of equipment, such as shafts and bearings
where accessible, from rust prior to operation by means of
protective grease coating and wrapping. Close pipe openings with
caps or plugs during installation. Pipe openings, equipment, and
plumbing fixtures shall be tightly covered against dirt or
mechanical injury. At completion of all work thoroughly clean
fixtures, exposed materials and equipment.

I. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000
psig) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE,
shall be used for all pad or floor mounted equipment.

J. Gages, thermometers, valves and other devices shall be installed with
due regard for ease in reading or operating and maintaining said
devices. Thermometers and gages shall be located and positioned to be
easily read by operator or staff standing on floor or walkway provided.
Servicing shall not require dismantling adjacent equipment or pipe
work.

K. Interconnection of Controls and Instruments: Electrical interconnection
is generally not shown but shall be provided. This includes
interconnections of sensors, transmitters, transducers, control
deVICES, control and instrumentation panels, alarms, instruments and
computer workstations. Comply with NFPA 70.

L. Many plumbing systems interface with the HVAC control system. See the
HVAC control points list and Section 23 09 23, DIRECT DIGITAL CONTROL
SYSTEM FOR HVAC.
M. Work in Existing Building:
   1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
   2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.

N. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.

O. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers putty.

P. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above data equipment, and electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Drain valve shall be provided in low point of casement pipe.

Q. Inaccessible Equipment:
   1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost or additional time to the Government.
   2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 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 shall be provided to maintain continuity of operation of existing facilities.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury
can occur to personnel by contact with operating facilities. The requirements of paragraph 3.1 shall apply.

C. Temporary facilities and piping shall be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs are not allowed in potable water systems. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

3.3 RIGGING

A. Openings in building structures shall be planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.

C. All openings in the building shall be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.

E. Contractor shall check all clearances, weight limitations and shall provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Rigging plan and methods shall be referred to COR for evaluation prior to actual work.

3.4 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 shall be drilled or burned in structural steel ONLY with the prior written approval of the COR.

B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.

C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents
use. A minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work shall be provided.

D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC) and these specifications.

E. Overhead Supports:
   1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
   2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
   3. Tubing and capillary systems shall be supported in channel troughs.

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 shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
   2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
   3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignement.
   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 shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.

B. All devices and equipment shall be equipped with required lubrication fittings. A minimum of one liter (one quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application shall be provided. All materials shall be
delivered to COR in unopened containers that are properly identified as to application.

C. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.

D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

E. All lubrication points shall be extended to one side of the equipment.

3.6 PLUMBING SYSTEMS DEMOLITION

A. Rigging access, other than indicated on the drawings, shall be provided after approval for structural integrity by the COR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris shall be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating plant, cleanliness and safety shall be maintained. The plant shall be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work shall be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris shall not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting shall be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. All work shall be performed in accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel of the VA Medical Center, and the Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained.
Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government property and shall be removed and delivered to COR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate. Coordinate with the COR and Infection Control.

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

3.7 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.

2. The following Material and Equipment shall NOT be painted:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.
   h. Valve stems and rotating shafts.
   i. Pressure gages and thermometers.
   j. Glass.
   k. Name plates.
3. Control and instrument panels shall be cleaned and damaged surfaces repaired. Touch-up painting shall 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 shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump manufacturer.

5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats per Section 09 91 00, Painting.

6. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this. Lead based paints shall not be used.

3.8 IDENTIFICATION SIGNS

A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, shall be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, and performance data shall be placed on factory built equipment.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.9 STARTUP AND TEMPORARY OPERATION

A. Startup of equipment shall be performed as described in the equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

B. The commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Contracting Officer’s Representative and Commissioning Agent. Provide a minimum of 2 weeks prior notice.

3.10 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, all required tests shall be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.
B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

C. When completion of certain work or systems occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings during the first actual seasonal use of the respective systems following completion of work. Rescheduling of these tests shall be requested in writing to COR for approval.

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 shall be included.

B. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.

C. Manufacturer’s installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.

D. Lubrication instructions, type and quantity of lubricant shall be included.

E. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.

F. Set points of all interlock devices shall be listed.

G. Trouble-shooting guide for the control system troubleshooting shall be inserted into the Operations and Maintenance Manual.

H. The control system sequence of operation corrected with submittal review comments shall 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 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.

--- END ---
SECTION 22 05 12
GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the general motor requirements for plumbing equipment and applies to all sections of Division 22.
B. A complete listing of 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 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

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 Bearing Manufacturers Association (ABMA):
   ABMA 9-1990 (R2008).....Load Ratings and Fatigue Life for Ball Bearings
C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   841-2009.................IEEE Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 HP)
D. International Code Council (ICC):
   IPC-2012..................International Plumbing Code
E. National Electrical Manufacturers Association (NEMA):
   MG 1-2011..................Motors and Generators
   250-2008.................Enclosures for Electrical Equipment (1000 Volts Maximum)
F. National Fire Protection Association (NFPA):
   70-2011...............National Electrical Code (NEC)
1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT", with applicable paragraph identification.

C. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
   2. Motor nameplate information shall be submitted including electrical ratings, dimensions, mounting details, materials, horsepower, power factor, current as a function of speed, current efficiency, speed as a function of load, RPM, enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
   3. Motor parameters required for the determination of the Reed Critical Frequency of vertical hollow shaft motors shall be submitted.

D. Operating and Maintenance Manuals: Companion copies of complete maintenance and operating manuals, including technical data sheets and application data shall be submitted simultaneously with the shop drawings. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable 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. Certification: Two weeks prior to final inspection, unless otherwise noted, the following certification shall be submitted to the Contracting Officer’s Representative (COR).
   1. Certification shall be submitted stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all
PART 2 - PRODUCTS

2.1 MOTORS

A. For alternating current, fractional and integral horsepower motors, NEMA MG 1 and NEMA MG 2 shall apply.

B. For severe duty totally enclosed motors, IEEE 841 shall apply.

C. Voltage ratings shall be as follows:

1. Single phase:
   a. Motors connected to 120-volt systems: 115 volts.
   b. Motors connected to 208-volt systems: 200 volts.
   c. Motors connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.

2. Three phase:
   a. Motors connected to 208-volt systems: 200 volts.
   b. Motors, less than 74.6 kW (100 HP), connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
   c. Motors, 74.6 kW (100 HP) or larger, connected to 240-volt systems: 230 volts.
   d. Motors, 74.6 kW (100 HP) or larger, connected to 480-volt systems: 460 volts.
   e. Motors connected to high voltage systems: Shall conform to NEMA MG 1 Standards for connection to the nominal system voltage shown on the drawings.

D. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

E. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting, acceleration and running torque without exceeding nameplate ratings or considering service factor.

F. Motor Enclosures:

1. Shall be the NEMA types shown on the drawings for the motors.

2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types per NEMA 250, which are most suitable
for the environmental conditions where the motors are being installed.

3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

4. All motors in hazardous locations shall be approved for the application and meet the Class and Group as required by the area classification.

G. Electrical Design Requirements:

1. Motors shall be continuous duty.

2. The insulation system shall be rated minimum of Class B, 130 degrees C (266 degrees F).

3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80 degrees C (144 degrees F).

4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.

5. Motors shall be suitable for full voltage starting, unless otherwise noted. Coordinate motor features with applicable motor controllers.

6. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable Voltage or Adjustable Frequency Controls, or both, or NEMA MG 1, Part 31, Definite Purpose Inverter Fed Polyphase Motors.

H. Mechanical Design Requirements:

1. Bearings shall be rated for a minimum fatigue life of 26,280 hours for belt-driven loads and 100,000 hours for direct-drive loads based on L10 (Basic Rating Life) at full load direct coupled, except vertical high thrust motors which require a 40,000 hour rating. A minimum fatigue life of 40,000 hours is required for VFD drives.

2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30 percent of normal down thrust.

3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.

4. Grease fittings, if provided, shall be Alemite type or equivalent.

5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 3.8 mm (0.15 inch) per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.
8. Motors on 180 frames and larger shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
9. All external fasteneners shall be corrosion resistant.
10. Condensation heaters, when specified, shall keep motor windings at least 5 degrees C (9 degrees F) above ambient temperature.
11. Winding thermostats, when specified shall be normally closed, connected in series.
12. Grounding provisions shall be in the main terminal box.
I. Additional requirements for specific motors, as indicated in other sections, shall also apply.
J. NEMA Premium Efficiency Electric Motors, Motor Efficiencies: All permanently wired polyphase motors of 746 W (1 HP) or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 W (1 HP) or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

<table>
<thead>
<tr>
<th>Rating kW (HP)</th>
<th>Minimum Efficiencies (Open Drip-Proof)</th>
<th>Minimum Efficiencies (Totally Enclosed Fan-Cooled)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.746 (1)</td>
<td>82.5% 85.5% 77.0%</td>
<td>0.746 (1) 82.5% 85.5% 77.0%</td>
</tr>
<tr>
<td>1.12 (1.5)</td>
<td>86.5% 86.5% 84.0%</td>
<td>1.12 (1.5) 87.5% 86.5% 84.0%</td>
</tr>
<tr>
<td>1.49 (2)</td>
<td>87.5% 86.5% 85.5%</td>
<td>1.49 (2) 88.5% 86.5% 85.5%</td>
</tr>
<tr>
<td>2.24 (3)</td>
<td>88.5% 89.5% 85.5%</td>
<td>2.24 (3) 89.5% 89.5% 86.5%</td>
</tr>
<tr>
<td>3.73 (5)</td>
<td>89.5% 89.5% 86.5%</td>
<td>3.73 (5) 89.5% 89.5% 88.5%</td>
</tr>
</tbody>
</table>

K. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM. Power factor correction capacitors shall be installed unless the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors in accordance with manufacturer’s recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

B. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

3.2 FIELD TESTS

Megger all motors after installation, before start-up. All shall test free from grounds.

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.

- - - E N D - - -
SECTION 22 05 19
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for water meters and gages primarily used for troubleshooting the system and to indicate system performance.

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 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

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):
   C700-2009..................Standard for Cold Water Meters, Displacement Type, Bronze Main Case
   C701-2012..................Cold Water Meters-Turbine Type, for Customer Service
   C702-2010.................Cold Water Meters - Compound Type
   C706-2010..................Direct-Reading, Remote-Registration Systems for Cold-Water Meters

D. Institute of Electrical and Electronics Engineers (IEEE):
   C2-2012..................National Electrical Safety Code (NESC)

E. International Code Council (ICC):
   IPC-2012..................International Plumbing Code

F. National Fire Protection Association (NFPA):
   70-2011..................National Electrical Code (NEC)

G. NSF International (NSF):
   61-2012..................Drinking Water System Components - Health Effects
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 GAGES 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 Gages.
3. Thermometers.
4. Product certificates for each type of meter and gage.
5. BACnet communication protocol.

D. Operations and Maintenance manual shall include:

1. System Description.
3. Troubleshooting and preventive maintenance guidelines.
4. Spare parts information.

E. Shop Drawings shall include the following: One line, wiring and terminal diagrams including terminals identified, protocol or communication modules, and Ethernet connections.

1.5 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit copies of complete operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be inserted into a three ring binder per the requirements of Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. 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. 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.

PART 2 – PRODUCTS

2.1 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 0.063 L/s (200 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.

2.4 WATER METER STRAINER

A. All meters shall be fitted with a factory installed integral strainer or bronze inlet strainer with top access. The strainer shall conform to AWWA C702.

B. The water meter strainer shall conform to NSF 61 and NSF 372.
2.5 WATER METER PROGRAMMING
A. All meters 50 mm or DN 50 (2 inches) and above shall be programmable with software supplied by the meter manufacturer.
B. The software shall have a Microsoft based interface and operate on the latest Windows operating system. The software shall allow the user to configure the meter, troubleshoot the meter, query and display meter parameters, and configure data and stored values.
C. The meter firmware shall be upgradeable through one of the communication ports without removing the unit from service.
D. The meter shall include output for analog 4-20 milliamp signals and binary output.
E. The meter shall have two dry contact relays outputs for alarm or control functions.

2.6 WATER METER COMMUNICATION PROTOCOL
A. The meter shall use a native BACnet Ethernet communication protocol supporting Modbus. The communications shall be protected against surges induced on its communications channels.

2.7 REMOTE READOUT REGISTER
A. All meters shall be equipped with a remote readout register in accordance with AWWA C706.

2.8 PRESSURE GAGES FOR WATER 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) gage.
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 gage for water domestic use shall conform to NSF 61 and NSF 372.

2.9 THERMOMETERS
A. Thermometers shall be straight stem, metal case, red liquid-filled thermometer, approximately 175 mm (7 inches) high, 4 degrees C to 100
degrees C (40 degrees F to 212 degrees F). Thermometers shall comply with ASME B40.200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Direct mounted pressure gages shall be installed in piping tees with pressure gage located on pipe at the most readable position.

B. Valves and snubbers shall be installed in piping for each pressure gage.

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 gages shall be installed where indicated on the drawings and at the following locations:
   1. Suction and discharge of each domestic water pump or re-circulating hot water return pump.
   2. Where indicated on drawings.

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 on 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 cost to the Government.

3.2 FIELD QUALITY CONTROL

A. The meter assembly shall be visually inspected and operationally tested. The correct multiplier placement on the face of the meter shall be verified.

3.3 TRAINING

A. A training course shall be provided to the medical center on meter configuration and maintenance. Training manuals shall be supplied for all attendees with four additional copies supplied. The training course shall cover meter configuration, troubleshooting, and diagnostic procedures.
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 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 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.
C. American Society of Sanitary Engineering (ASSE):
   1017-2009............Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems
   1069-2005.............Performance Requirements for Automatic Temperature Control Mixing Valves
   1070-2004.............Performance Requirements for Water Temperature Limiting Devices
D. American Society for Testing and Materials (ASTM):
   B62-2009...............Standard Specification for Composition Bronze or Ounce Metal Castings
   B584-2013..............Standard Specification for Copper Alloy Sand Castings for General Applications
E. International Code Council (ICC):
   IPC-2012...............International Plumbing Code
F. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
   SP-25-2008..............Standard Marking Systems for Valves, Fittings, Flanges and Unions
   SP-67-2011..............Butterfly Valves
   SP-70-2011..............Gray Iron Gate Valves, Flanged and Threaded Ends
   SP-71-2011..............Gray Iron Swing Check Valves, Flanged and Threaded Ends
   SP-80-2013..............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):

H. NSF International (NSF):
   61-2012.................Drinking Water System Components – Health Effects
   372-2011.................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 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.
   5. Check Valves.
10. Thermostatic Mixing Valves.

D. Test and Balance reports for balancing valves.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable 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.
   4. Piping diagrams of thermostatic mixing valves to be installed.

F. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

G. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 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.
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 more 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-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

2.2 SHUT-OFF VALVES

A. Cold, Hot and Re-circulating Hot Water:
   1. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-110, Ball valve shall be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4138 kPa (600 psig). The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be non-lead solder.
   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 larger:
   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 above.
   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, 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 BALANCING VALVES

A. Hot Water Re-circulating, 75 mm or DN75 (3 inches) and smaller manual balancing valve shall be of bronze body, brass ball construction with glass and carbon filled TFE seat rings and designed for positive shutoff. The manual balancing valve shall have differential pressure read-out ports across the valve seat area. The read out ports shall be fitting with internal EPT inserts and check valves. The valve body shall have 8 mm or DN8 NPT (1/4 inch NPT) tapped drain and purge port. The valves shall have memory stops that allow the valve to close for service and then reopened to set point without disturbing the balance position. All valves shall have calibrated nameplates to assure specific valve settings.
B. Larger than 75 mm or DN75 (3 inches): Manual balancing valves shall be of heavy duty cast iron flanged construction with 861 kPa (125 psig) flange connections. The flanged manual balancing valves shall have either a brass ball with glass and carbon filled TFE seal rings or fitted with a bronze seat, replaceable bronze disc with EPDM seal insert and stainless steel stem. The design pressure shall be 1200 kPa (175 psig) at 121 degrees C (250 degrees F).

2.4 CHECK VALVES

A. 75 mm or DN75 (3 inches) and smaller shall be Class 125, bronze swing check valves with non-metallic disc suitable for type of service. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B62, solder joints, and PTFE or TFE disc.

B. 100 mm or DN100 (4 inches) and larger:

1. Check valves shall be Class 125, iron swing check valve with lever and weight closure control. The check valve shall meet MSS SP-71 Type I standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a clear or full waterway body design with gray iron body material conforming to ASTM A126, bolted bonnet, flanged ends, bronze trim.

2. All check valves on the discharge side of submersible sump pumps shall have factory installed exterior level and weight with sufficient weight to prevent the check valve from hammering against the seat when the sump pump stops.

2.5 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 handwheel.

B. Larger 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.
2.6 THERMOSTATIC MIXING VALVES

A. Thermostatic Mixing Valves shall comply with the following general performance requirements:
1. Shall meet ASSE requirements for water temperature control.
2. The body shall be cast bronze or brass with corrosion resistant internal parts preventing scale and biofilm build-up. Provide chrome-plated finish in exposed areas.
3. No special tool shall be required for temperature adjustment, maintenance, replacing parts and disinfecting operations.
4. Valve shall be able to be placed in various positions without making temperature adjustment or reading difficult.
5. Valve finish shall be chrome plated in exposed areas.
6. Valve shall allow easy temperature adjustments to allow hot water circulation. Internal parts shall be able to withstand disinfecting operations of chemical and thermal treatment of water temperatures up to 82°C (180°F) for 30 minutes or 50 mg/L (50 ppm) chlorine residual concentration for 24 hours.
7. Parts shall be easily removed or replaced without dismantling the valves, for easy scale removal and disinfecting of parts.
8. Valve shall have a manual adjustable temperature control with locking mechanism to prevent tampering by end user. Outlet temperature shall be visible to ensure outlet temperature does not exceed specified limits, particularly after thermal eradication procedures.
9. Provide mixing valves with integral check valves with screens and stop valves.

B. Master Thermostatic Water Mixing Valves:
1. Application: Tempered water distribution from hot water source.
3. Pressure Rating: 861 kPa (125 psig).
4. Type: Exposed-mounting or Cabinet-type, as indicated, thermostatically controlled water mixing valve.
5. Connections: Flanged or threaded union inlets and outlet.
7. Cabinet: Factory-fabricated, stainless steel, for recessed or surface mounting and with hinged, stainless-steel door.
8. Thermometers shall be provided to indicate mixed water temperature.
9. Provide a high temperature alarm device to detect mixing valve failure.

C. Hi-Lo Water-Mixing-Valve Assemblies:
1. Application: Tempered water distribution from hot water source covering a wide range of flow.
2. Description: Factory-fabricated, cabinet-type or exposed-mounting, thermostatically controlled, water-mixing-valve assembly in two-valve parallel arrangement including pressure regulators, pressure gages and thermometer.
3. Large-Flow Parallel: Master thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
5. Master Thermostatic Mixing Valves: Comply with ASSE 1017.
6. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
7. Component Pressure Ratings: 861 kPa (125 psig) minimum, unless otherwise indicated.
8. Cabinet: Factory-fabricated, stainless steel, for recessed or surface mounting and with hinged, stainless-steel door.
9. Connections: Soldered or threaded union inlets and outlet.
10. Thermometers shall be provided to indicate mixed water temperature.
11. Provide a high temperature alarm device to detect mixing valve failure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.
B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.
C. Threads on valve and mating pipe shall be examined for form and cleanliness.
D. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its
material composition is suitable for service and free from defects and
damage.
E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION
A. Install valves with unions or flanges at each piece of equipment
   arranged to allow service, maintenance, and equipment removal without
   system shutdown.
B. Valves shall be located for easy access and shall be provide with
   separate support. Valves shall be accessible with access doors when
   installed inside partitions or above hard ceilings.
C. Valves shall be installed in horizontal piping with stem at or above
   center of pipe.
D. Valves shall be installed in a position to allow full stem movement.
E. Check valves shall be installed for proper direction of flow and as
   follows:
   1. Swing Check Valves: In horizontal position with hinge pin level and
      on top of valve.
F. If an installation is unsatisfactory to the COR, the Contractor shall
   correct the installation at no cost to the Government.

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.
B. Distinguish among multiple units, inform operator of operational
   requirements, indicate safety and emergency precautions, and warn of
   hazards and improper operations, in addition to identifying unit.

3.4 ADJUSTING
A. Valve packing shall be adjusted or replaced after piping systems have
   been tested and put into service but before final adjusting and
   balancing. Valves shall be replaced if persistent leaking occurs.
B. Set field-adjustable flow set points of balancing valves and record
   data. Ensure recorded data represents actual measured or observed
   conditions. Permanently mark settings of valves and other adjustment
   devices allowing settings to be restored. Set and lock memory stops.
   After adjustment, take measurements to verify balance has not been
   disrupted or that such disruption has been rectified.
C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

D. Testing and adjusting of balancing valves shall be performed by an independent NEBB Accredited Test and Balance Contractor. A final settings and flow report shall be submitted to the VA Contracting Officer's Representative (COR).

3.5 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.

3.6 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.
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. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, and pipe basements are not considered finished areas.
   6. FSK: Foil-scrim-Kraft facing.
   7. Hot: Plumbing equipment or piping handling media above 40 degrees C (104 degrees F).
   8. Density: kg/m³ - kilograms per cubic meter (Pcf - pounds per cubic foot).
      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. SCW: 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 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL

F. 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.

G. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING: Hot and cold water piping.

H. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.

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 basic designation only.

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

   B209-2014..............Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate


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.


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

D1668/D1668M-1997a (2014)e1 Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing


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-C-20079H-1987.......Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

F. National Fire Protection Association (NFPA):

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; http://www.pipeinsulation.net

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 07 11, PLUMBING INSULATION”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
D. Shop Drawings:
1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM Designation, Federal and Military specifications.
   a. Insulation materials: Specify each type used and state surface burning characteristics.
   b. Insulation facings and jackets: Each type used and state surface burning characteristics.
   c. Insulation accessory materials: Each type used.
   d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation shall follow the guidelines in accordance with ASTM C1710.
   e. Make reference to applicable specification paragraph numbers for coordination.
   f. All insulation fittings (exception flexible unicellular insulation) shall be fabricated in accordance with ASTM C450 and the referenced Adjunct to ASTM C450.

1.5 QUALITY ASSURANCE

A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

B. Criteria:
1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.11.2.6, parts of which are quoted as follows:
   4.3.3.1 Pipe and duct insulation and coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels and duct silencers used in duct systems shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with ASTM E84 and appropriate mounting practice, e.g. ASTM E2231.
   4.3.3.3 Coverings and linings for air ducts, pipes, plenums and panels including all pipe and duct insulation materials shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service. In no case shall the test temperature be below 121 degrees C (250 degrees F).
   4.3.11.2.6.3 Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with

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 2015 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/m³ (nominal 3 pcf), $k = 0.037 \ (0.26)$ at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).

B. ASTM C553 (Blanket, Flexible) Type I, Class B-5, Density 32 kg/m³ (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 CELLULAR GLASS CLOSED-CELL

A. Comply with Standard ASTM C552, density 120 kg/m³ (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).

2.4 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be ASJ or PVDC Vapor Retarder jacketing.

B. ASJ shall be white finish (kraft paper) bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture is 50 units, suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: FSK or PVDC type for concealed ductwork and equipment.

D. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2070 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.
E. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be PVC conforming to Fed Spec L-P-535E, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape. Staples, tacks, or any other attachment that penetrates the PVC covering is not allowed on any form of a vapor barrier system in below ambient process temperature applications.

2.5 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/m³ (3.0 pcf).

<table>
<thead>
<tr>
<th>Nominal Pipe Size mm (inches)</th>
<th>Insert Blocks mm (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up through 125 (5)</td>
<td>150 (6) long</td>
</tr>
<tr>
<td>150 (6)</td>
<td>150 (6) long</td>
</tr>
<tr>
<td>200 (8), 250 (10), 300 (12)</td>
<td>225 (9) long</td>
</tr>
<tr>
<td>350 (14), 400 (16)</td>
<td>300 (12) long</td>
</tr>
<tr>
<td>450 through 600 (18 through 24)</td>
<td>350 (14) long</td>
</tr>
</tbody>
</table>

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/m³ (3.0 pcf).

2.6 ADHESIVE, MASTIC, CEMENT

C. Mil. Spec. MIL-A-24179A, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general 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.

2.7 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.

2.8 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.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Required pressure tests of piping joints and connections shall be completed and the work approved by the Contracting Officer's Representative (COR) for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions or as noted, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.

C. Where removal of insulation of piping and equipment is required to comply with Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT and Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT, such areas shall be reinsulated to comply with this specification.

D. Insulation materials shall be installed with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down and sealed at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A).

E. Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 15 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

F. Install vapor stops with operating temperature 15 degrees C (60 degrees F) and below at all insulation terminations on either side of valves, pumps, fittings, and equipment and particularly in straight lengths every 4.6 to 6.1 meters (approx. 15 to 20 feet) of pipe insulation. The annular space between the pipe and pipe insulation of approx. 25 mm (1 inch) in length at every vapor stop shall be sealed with appropriate vapor barrier sealant. Bio-based materials shall be utilized when possible.

G. 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.

3.2 INSULATION INSTALLATION

A. Molded Mineral Fiber Pipe and Tubing Covering:
1. Fit insulation to pipe, aligning all longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation except for cold piping. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide cellar glass inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
   a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 15 degrees C (60 degrees F) or more.
   
   b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts surface temperature of above 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Provide mitered preformed insulation of the same type as the installed straight pipe insulation for pipe temperatures below 4 degrees C (40 degrees F). Secure first layer of mineral fiber insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
   
   c. Factory preformed, ASTM C547 or fabricated mitered sections, joined with adhesive or (hot only) wired in place. (Bio-based materials shall be utilized when possible.) For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 15 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
   
   d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).

3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

B. 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 impregnated glass fabric, bituminous mastic and outside protective plastic film.
   
   a. 75 mm (3 inches) thick for hot water piping.
   
   b. As scheduled at the end of this section for chilled water piping.
   
   c. Underground piping: Apply insulation with joints tightly butted. Seal longitudinal self-sealing lap. Use field fabricated or factory made fittings. Seal butt joints and fitting with jacketing as recommended by the insulation manufacturer. Use 100 mm (4 inch) wide strips to seal butt joints.
d. Provide expansion chambers for pipe loops, anchors and wall penetrations as recommended by the insulation manufacturer.

e. Underground insulation shall be inspected and approved by the 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.

### 3.3 PIPE INSULATION SCHEDULE

A. Provide insulation for piping systems as scheduled below:

<table>
<thead>
<tr>
<th>Operating Temperature Range/Service</th>
<th>Insulation Material</th>
<th>Insulation Thickness Millimeters (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Less than 25 (1)</td>
</tr>
<tr>
<td>38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)</td>
<td>Mineral Fiber (Above ground piping only)</td>
<td>38 (1.5)</td>
</tr>
<tr>
<td>38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)</td>
<td>Cellular Glass Thermal</td>
<td>38 (1.5)</td>
</tr>
<tr>
<td>4-15 degrees C (40-60 degrees F)</td>
<td>Cellular Glass Thermal</td>
<td>38 (1.5)</td>
</tr>
</tbody>
</table>

--- END ---
 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
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 REQUIREMENTS. All testing shall be incorporated into the project schedule. The Commissioning Agent will witness and document the testing. Contractor tests shall be completed prior to scheduling the following systems: Functional Performance Testing, and System Startup 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, system performance under emergency conditions, and system performance under normal operating conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall perform the required tests prior to approval. The Contractor shall document and report the results of the testing. The Commissioning Agent shall witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for additional details.

3.5 TRAINING OF VA PERSONNEL

A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00. The training agenda shall be scheduled in coordination with the Resident Engineer. The training shall be verified, and the training agenda approved. The training shall be performed in coordination with the Resident Engineer after submission and approval of formal training plan. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for additional training requirements.
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 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

F. Section 22 07 11, PLUMBING INSULATION.

G. 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
B16.51-2013..........Copper and Copper Alloy Press-Connect Fittings
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):
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
A403/A403M-2014........Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
A733-2013..............Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
B32-2008 (R2014).......Standard Specification for Solder Metal
B61-2008 (R2013).......Standard Specification for Steam or Valve Bronze Castings
B62-2009...............Standard Specification for Composition Bronze or Ounce Metal Castings
B75/B75M-2011.........Standard Specification for Seamless Copper Tube
B88-2014...............Standard Specification for Seamless Copper Water Tube
B584-2014.............Standard Specification for Copper Alloy Sand Castings for General Applications
C919-2012.............Standard Practice for Use of Sealants in Acoustical Applications
D2000-2012.............Standard Classification System for Rubber Products in Automotive Applications
E1120-2008.............Standard Specification for Liquid Chlorine
E1229-2008.............Standard Specification for Calcium Hypochlorite

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-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):
61-2014a..............Drinking Water System Components - Health Effects
1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 11 00, FACILITY WATER DISTRIBUTIONS”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. All items listed in Part 2 - Products.

D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

E. Completed System Readiness Checklist provided by the CxA and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

F. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. A certificate shall be submitted prior to welding of steel piping showing the Welder’s certification. The certificate shall be current and no more than one year old. Welder’s qualifications shall be in accordance with ASME BPVC Section IX.

B. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.

C. All pipe, couplings, fittings, and specialties shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.
D. Bio-Based Materials: For products designated by the USDA’s Bio-
Preferred Program, provide products that meet or exceed USDA
recommendations for bio-based content, so long as products meet all
performance requirements in this specifications section. For more
information regarding the product categories covered by the Bio-
Preferred Program, visit http://www.biopreferred.gov.

1.6 SPARE PARTS
A. For mechanical press-connect fittings, provide tools required for each
pipe size used at the facility.

1.7 AS-BUILT DOCUMENTATION
A. Submit manufacturer’s literature and data updated to include submittal
review comments and any equipment substitutions.
B. Submit operation and maintenance data updated to include submittal
review comments, substitutions and construction revisions shall be in
electronic version on compact disc or DVD 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 2015
provided on compact disk or DVD. Should the installing contractor
engage the testing company to provide as-built or any portion thereof,
it shall not be deemed a conflict of interest or breach of the ‘third
party testing company’ requirement.
D. Certification documentation shall be provided to COR 10 working days
prior to submitting the request for final inspection. The documentation
shall include all test results, the names of individuals performing
work for the testing agency on this project, detailed procedures
followed for all tests, and certificate if applicable that all results of tests were within limits specified. If a certificate is not available, all documentation shall be on the Certifier’s letterhead.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material or equipment containing a weighted average of greater than 0.25 percent lead are prohibited in any potable water system intended for human consumption, and shall be certified in accordance with NSF 61 or NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61, Section 9.

B. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended.

2.2 ABOVE GROUND (INTERIOR) WATER PIPING

A. Pipe: Copper tube, ASTM B88, Type K or L, drawn.

B. Fittings for Copper Tube:

1. Wrought copper or bronze castings conforming to ASME B16.18 and B16.22. Unions shall be bronze, MSS SP-72, MSS SP-110, solder or braze joints. Use 95/5 tin and antimony for all soldered joints.

2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75/B75M C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, C84400. Mechanical grooved couplings, 2070 kpa (300 psig) minimum ductile iron, ASTM A536 Grade 448-310-12 (Grade 65-45-12), or malleable iron, ASTM A47/A47M Grade 22410 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

3. Mechanical press-connect fittings for copper pipe and tube shall conform to the material and sizing requirements of ASME B16.51, NSF 61 approved, 50 mm (2 inch) size and smaller mechanical press-connect fittings, double pressed type, with EPDM (ethylene propylene diene monomer) non-toxic synthetic rubber sealing elements and unpressed fitting identification feature.

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. Adapters: Provide adapters for joining pipe or tubing with dissimilar end connections.

D. Solder: ASTM B32 alloy type Sb5, HA or HB. Provide non-corrosive flux.

E. Brazing alloy: AWS A5.8M/A5.8, brazing filler metals shall be BCuP series for copper to copper joints and BAg series for copper to steel joints.

2.3 EXPOSED WATER PIPING

A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.


2. Fittings: ASME B16.15 cast bronze threaded fittings with chrome finish.


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 STRAINERS

A. Provide 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.

2.5 DIELECTRIC FITTINGS

A. Provide dielectric couplings or unions between pipe of dissimilar metals.
2.6 STERILIZATION CHEMICALS
   A. Hypochlorite: ASTM E1120.
   B. Liquid Chlorine: ASTM E1229.

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.

8. Mechanical press-connect fitting connections shall be made in accordance with the manufacturer’s installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. Ensure the tube is completely inserted to the fitting stop (appropriate depth) and squared with the fitting prior to applying the pressing jaws onto the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer. Minimum distance between fittings shall be in accordance with the manufacturer’s requirements. When the pressing cycle is complete, visually inspect the joint to ensure the tube has remained fully inserted, as evidenced by the visible insertion mark.

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 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. All Other Piping Tests: Test new installed piping under 1-1/2 times actual operating conditions and prove tight.
D. The test pressure shall hold for the minimum time duration required by the applicable plumbing code or authority having jurisdiction.

3.3 STERILIZATION
A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.
B. Use liquid chlorine or hypochlorite for sterilization.

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 35 00
DOMESTIC WATER HEAT EXCHANGERS

PART 1 - GENERAL

1.1 DESCRIPTION
A. This section describes the requirements for domestic hot water heat exchangers including thermometers and all necessary accessories, connections and equipment.
B. Application is for indirect water heating utilizing steam or hot water as a medium, and can be used for heat recovery or solar systems for pre-heating water prior to primary water heating equipment.
C. 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 03 30 53, CAST-IN-PLACE CONCRETE
E. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
F. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING.
G. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING.
H. Section 22 07 11, PLUMBING INSULATION.
I. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
J. Section 22 11 00, FACILITY WATER DISTRIBUTION: Piping, Fittings, Valves and Gages.
K. Section 22 11 23, DOMESTIC WATER PUMPS: Circulating Pump.

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 for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
C. American National Standard Institute (ANSI):
   Z21.22B-2001 (R2008)....Relief Valves for Hot Water Supply Systems
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 35 00, DOMESTIC WATER HEAT EXCHANGERS”, 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.
   3. Pressure and Temperature Relief Valves.
   4. Steam Control Valves.
5. Heating Hot Water Control Valves.
6. Thermometers.
7. Pressure Gages.
8. Vacuum Breakers.
10. Expansion Tanks.

D. A form U-1 or other documentation stating compliance with the ASME Boiler and Pressure Vessel Code.

E. Shop drawings shall include wiring diagrams for power, signal and control functions.

F. Submit documentation indicating compliance with applicable requirements of ASHRAE 90.1, Unfired Storage Tanks, for Service Water Heating.

G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable 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.

H. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

I. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. Equipment components in contact with potable water shall meet compliance requirements in documents NSF 61 and NSF 372.

B. Comply with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1 for efficiency performance.

C. The heat exchanger shall be certified and labeled by an independent testing agency.

D. Circulating pump shall be installed per NFPA 70.

1.6 AS-BUILT DOCUMENTATION

A. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be
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.

B. 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 on Auto-Cad version 2015 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.

PART 2 - PRODUCTS

2.1 SHELL AND TUBE, DOMESTIC WATER HEAT EXCHANGERS

A. The shell and tube heat exchangers shall be double wall semi-instantaneous type, horizontal with water in the shell and heating hot water in the tubes. Heat exchanger shall be of counterflow design. The shell and tube heat exchanger shall be a packaged assembly of tank, heat exchanger coils, control valves, controls, and specialties constructed of ASME code stainless steel shell with 1035 kPa (150 psig) minimum working pressure. Heat exchanger shall comply with NSF 61 and NSF 372 for barrier materials for potable-water tank linings. Provide with access for cleaning and disinfection. Heat exchanger capacities are scheduled on the drawings.

B. The stand or skid shall be factory fabricated for floor mounting.

C. The tappings (openings) shall be factory fabricated of materials compatible with the tank and in accordance with appropriate ASME standards for piping connections, pressure and temperature relief valve, pressure gauge, thermometer, drain valve, anode rods and controls. The openings shall be in accordance with ASME standards listed below:
1. 50 mm or DN50 (2 inch) and smaller: Threaded ends according to ASME B1.20.1.
2. 65 mm or DN65 (2-1/2 inch) and larger: Flanged ends according to ASME B16.5 for steel and stainless steel flanges, and according to ASME B16.24.

D. Shell insulation shall comply with ASHRAE 90.1 and suitable for operating temperature. The entire shell and nozzles shall be completely surrounded except connections, gages and controls.

E. The heat exchanger coils shall be constructed from copper and fabricated in a helix wound for heating hot water heating medium. The pressure rating shall be equal to or greater than the heating hot water supply pressure plus 50 percent.

F. The temperature controls shall be designed for an output temperature of 60 degrees C (140 degrees F) based upon an adjustable temperature transmitter that operates a control valve and is capable of maintaining outlet water temperature within 2 degrees C (4 degrees F) of setting. Heaters shall be capable of raising the discharge temperature to 77-82 degrees C (170-180 degrees F) for thermal eradication.

3. Heating hot water control valve shall regulate the flow of heating hot water to the heating coil to control water temperature and shall be electronically operated. The outlet water temperature shall not vary more than +/- 1 degrees C (2.5 degrees F).

4. A normally closed solenoid valve shall be rated at 5 amps, 120-volt. Solenoid valve shall close the heating hot water supply to the heating coil, should the water temperature in the tank reach the high set point.

G. Safety control shall be automatic, high temperature limit shutoff device.

H. The relief valves shall be ASME rated and stamped for combination temperature and pressure relief valves.

2.2 STEAM FIRED DOMESTIC WATER HEATER

A. Furnish vertical type steam fired domestic water heaters as a complete factory steam tested package ready for installation. Unit shall be mounted on a powder coated floor stand and allow for tube bundle removal without removing the heat exchanger from the stand.

B. Unit shall be ASME Code constructed and stamped in accordance with Section VIII, Division 1, for unfired pressure vessels. Shell construction shall be 316L grade stainless steel, ¼” OD single double
wall copper seamless tubes, brass heavy ¾” tube sheet inner and steel outer, and close
C. grained cast iron steam head. Shell to be rated at 150 psi @ 375 f.
Shell insulation shall be 2” high-density “Airglass” insulation with optional metal jacket outer covering to meet or exceed ASHRAE 90.1. All components in contact with domestic water to comply with NSF61 standard for no lead.
D. Furnish with a bronze pressure-temperature combination relief valve ASME Code stamped on the shell.
E. Furnish with a single-seated, BV Type, steam control valve with soft seat construction and bubble tight Class VI shutoff. Steam valve to be electronic type with fail close spring return actuator.
F. Furnish with a float and thermostatic steam trap assembly sized at 1 psig differential pressure.
G. Furnish with a 4½” dial combination pressure vacuum gauge for tube side steam and vacuum breaker.
H. Controls:
   1. Unit to be supplied with digital microprocessor temperature controller, with electronic output to control valve. Controller shall limit and control internal steam flow & rate to control outlet water temperature. Controller shall have a dual function, high-limit shutoff that will open shell drain valve and close inlet steam control valve simultaneously on pre-determined high limit set point. Control panel shall have white power ‘on’ light and red ‘over temperature’ light. Controller shall automatically reset when normal operating temperature limit is restored. Control panel shall be UL Listed with NEMA 4 rated enclosure.
I. Unit shall be hydro and on-line steam tested before shipment to the field with certified test papers furnished.

2.3 STORAGE WATER HEATER
A. Furnish vertical storage tank as a complete factory tested package ready for installation.
B. Tank shall be ASME Code constructed and stamped in accordance with Section VIII, Division 1, for unfired pressure vessels, and rated for 125 psig @375F. Shell construction shall be carbon steel with glass lined interior NSF 61 approved for potable water. All couplings and flanges shall be SA182-304 or SS304 material. Exterior shall be prime
REPLACE HOT WATER TANKS, BUILDINGS 1 & 2

C. Furnish with a bronze pressure-temperature relief valve set at 125 psig @ 210f, ASME Code rated for the total btu/hr capacity of the heater. Relief valve to be installed on the tank per manufactures recommendations and will ship loose for contractor installation.

D. Unit shall be hydro and on-line operationally tested before shipment to the field with certified test papers furnished.

2.4 STORAGE WATER HEATER WITH HEAT EXCHANGER

A. Furnish vertical storage type domestic water heaters as a complete factory tested package ready for installation, using steam as the heating source.

B. Tank shall be ASME Code constructed and stamped in accordance with Section VIII, Division 1, for unfired pressure vessels, and rated for 125 psig @ 375F. Shell construction shall be carbon steel with glass lined interior NSF 61 approved for potable water. All couplings and flanges shall be SA182-304 or SS304 material. Exterior shall be prime painted and insulated. Insulation shall be 2” high-density fiberglass with a stucco embossed metal jacket outer covering.

C. Internal double wall tube bundle shall be ¾” 20 Gauge copper seamless tubes with 304 SS tube sheet & tube separators, and close grained cast iron or fabricated steel head. Tube side ASME rated for 150 psig @ 375F.

D. Furnish with a bronze pressure-temperature relief valve set at 125 psig @ 210f, ASME Code rated for the total btu/hr capacity of the heater. Relief valve to be installed on the tank per manufactures recommendations.

E. Furnish with 316L Stainless Steel recirculation pump with check valve and isolation valves.

F. Furnish with a 4½” dial thermometer with SS well 0-250F range.

G. Furnish with a single-seated, BV type control valve with Stainless Steel body and trim and dead tight Class IV shutoff. Control valve to be electronic type with fail close spring return actuator rated for pressure and temperature of service.

H. Furnish with a float and thermostatic steam trap assembly sized at 1 psig differential pressure.

I. Controls:
1. Unit shall be supplied with digital microprocessor PID temperature controller, with electronic output to single-seated control valve. Controller shall limit and control steam rate to control outlet water temperature +/− 4 degree F. Controller shall have an adjustable high-limit shutoff that will close inlet water to the control valve at high limit set point. Control panel shall have white power ‘on’ light and red ‘over temperature’ light. Controller shall automatically reset when normal operating temperature limit is restored. Control panel shall be UL Listed with NEMA 4 rated enclosure.

J. Unit shall be hydro and on-line operationally tested before shipment to the field with certified test papers furnished.

2.5 THERMOMETERS
A. Thermometers shall be rigid stem or remote sensing, scale or dial type with an aluminum, black metal, stainless steel, or chromium plated brass case. The thermometer shall be back connected, red liquid (alcohol or organic-based) fill, vapor, bi-metal or gas actuated, with 225 mm (9 inches) high scale dial or circular dial 50 to 125 mm (2 to 5 inches) in diameter graduated from 4 to 100 degrees C (40 to 210 degrees F), with two-degree graduations guaranteed accurate within one scale division. The socket shall be separable, double-seat, micrometer-fittings, with extension neck not less than 65 mm (2 1/2 inches) to clear tank or pipe covering. The thermometer shall be suitable for 20 mm (3/4 inch) pipe threads. Thermometers may be console-mounted with sensor installed in separate thermometer well.

2.6 SAFETY VALVES FOR SHELL AND COIL HEATERS
A. Separate combination pressure/temperature relief valves shall be provided on each water heater.

B. A double solenoid safety system shall be provided for each shell and coil heater to function as a safety over temperature prevention system. System shall consist of aquastat, pilot light, solenoid safety valve and solenoid water safety valve located in the control circuit. The aquastat shall be set at 60 degrees C (140 degrees F).

2.7 DOMESTIC HOT WATER EXPANSION TANKS
A. A steel pressure rated tank constructed with welded joints and factory installed butyl rubber diaphragm shall be installed as scheduled. The air precharge shall be set to minimum system operating pressure at tank.
B. The tappings shall be factory fabricated steel, welded to the tank and include ASME B1.20.1 pipe thread.
C. The interior finish shall comply with NSF 61 and NSF 372 for barrier materials for potable water tank linings and the liner shall extend into and through the tank fittings and outlets.
D. The air charging valve shall be factory installed.

2.8 HEAT TRAPS
A. Heat traps shall be installed in accordance with ASHRAE 90.1 unless provided integrally with the heaters.

2.9 COMBINATION TEMPERATURE AND PRESSURE RELIEF VALVES
A. The combination pressure and temperature relief Valve shall be ANSI Z21.22 and ASME rated and constructed of all brass or bronze with a self-closing reseating valve. The relief valves shall include a relieving capacity greater than the heat input and include a pressure setting less than the water heater’s working pressure rating. Sensing element shall extend into storage tank.

PART 3 - EXECUTION

3.1 INSTALLATION
A. The water heaters shall be installed on concrete bases. Refer to Specification Section 03 30 00, CAST-IN-PLACE CONCRETE and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
B. The water heaters shall be installed level and plumb and securely anchored.
C. Water heaters shall be installed and connected in accordance with manufacturer’s written instructions with manufacturer’s recommended clearances.
D. All pressure and temperature relief valves discharge shall be piped to nearby floor drains with air gap or break.
E. Thermometers and isolation valves shall be installed on water heater inlet and outlet piping and shall be positioned such that they can be read by an operator or staff standing on floor or walkway.
F. The thermostatic control shall be set for a minimum setting of 60 degrees C (140 degrees F) for storage heaters and regulated to a maximum discharge temperature of 54 degrees C (130 degrees F) for distribution to personnel.
G. Shutoff valves shall be installed on the domestic water supply piping to the water heater and on the domestic hot water outlet piping.
H. All manufacturer’s required clearances shall be maintained.
I. A combination temperature and pressure relief valve shall be installed at the top portion of the storage tank. The sensing element shall extend into the tank. The relief valve outlet drain piping shall discharge by positive air gap into a floor drain.

J. Piping type heat traps shall be installed on the inlet and outlet piping of the domestic water heater storage tanks, unless provided integrally with the tanks.

K. Water heater drain piping shall be installed as indirect waste to spill by positive air gap into open drains or over floor drains. Hose end drain valves shall be installed at low points in water piping for gas fueled domestic hot water heaters without integral drains.

L. Dielectric unions shall be provided if there are dissimilar metals between the water heater connections and the attached piping.

M. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

3.2 LEAKAGE TEST

A. Before piping connections are made, the water heaters shall be tested at a hydrostatic pressure of 1380 kPa (200 psig) for water heaters rated at less than 1103 kPa (160 psig) and 1654 kPa (240 psig) for units with an maximum working pressure of 1103 kPa (160 psig) or over. Any failed test shall be corrected and the water heater shall be replaced with a new unit at no additional cost to the VA.

3.3 PERFORMANCE TEST

A. Ensure that all of the remote water outlets will have a minimum of 43 degrees C (110 degrees F) and a maximum of 49 degrees C (120 degrees F) water flow at all times. If necessary, make all correction to balance the return water system or reset the thermostat to make the system comply with design requirements.

3.4 STARTUP AND TESTING

A. As recommended by product manufacturer and listed standards and under actual or simulated operating conditions, tests shall be conducted to prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with each integrated system.

B. The tests shall include system capacity, control function, and alarm functions.

C. When any defects are detected, correct defects and repeat test at no additional costs to the Government.
D. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Contracting Officer’s Representative and Commissioning Agent. Provide a minimum of 7 days prior to notice.

3.5 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.

3.6 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 - - -
PART 1 - GENERAL

1.1 DESCRIPTION
A. The requirements of this Section apply to all sections of Division 23.
B. Definitions:
   1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
   2. Option or optional: Contractor's choice of an alternate material or method.
   3. RE: Resident Engineer
   4. COTR: Contracting Officer’s Technical Representative.

1.2 RELATED WORK
A. Section 01 00 00, GENERAL REQUIREMENTS
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES
C. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT
D. Section 03 30 53, CAST-IN-PLACE CONCRETE.
E. Section 07 84 00, FIRESTOPPING
F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS
G. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT
H. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC
I. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
J. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS
K. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUITS and CABLES.

1.3 QUALITY ASSURANCE
A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All
construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC

B. Flow Rate Tolerance for HVAC Equipment: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

C. Equipment Vibration Tolerance:

1. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Equipment shall be factory-balanced to this tolerance and re-balanced on site, as necessary.

2. After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

D. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.

2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.

3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent than those specified. Refer any conflicts to the Resident Engineer.

4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.

5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on
equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

7. Asbestos products or equipment or materials containing asbestos shall not be used.

E. Equipment Service Organizations:

1. HVAC: Products and systems shall be supported by service organizations that maintain a complete inventory of repair parts and are located within 50 miles to the site.

F. HVAC Mechanical Systems Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:

1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".

2. Comply with provisions of ASME B31 series "Code for Pressure Piping".

3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

G. Execution (Installation, Construction) Quality:

1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Resident Engineer for resolution. Provide written hard copies or computer files of manufacturer's installation instructions to the Resident Engineer at least two weeks prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations is a cause for rejection of the material.

2. Provide complete layout drawings required by Paragraph, SUBMITTALS. Do not commence construction work on any system until the layout drawings have been approved.

H. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.
1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and with requirements in the individual specification sections.

B. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.

C. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

D. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

E. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient.

F. Layout Drawings:

1. Submit complete consolidated and coordinated layout drawings for all new systems, and for existing systems that are in the same areas. Refer to Section 00 72 00, GENERAL CONDITIONS, Article, SUBCONTRACTS AND WORK COORDINATION.

2. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed layout drawings of all piping and duct systems.

3. Do not install equipment foundations, equipment or piping until layout drawings have been approved.

4. In addition, for HVAC systems, provide details of the following:
a. Mechanical equipment rooms.
c. Hangers, inserts, supports, and bracing.
d. Pipe sleeves.
e. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

G. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the Resident Engineer.
2. Submit electric motor data and variable speed drive data with the driven equipment.
3. Equipment and materials identification.
5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
6. Wall, floor, and ceiling plates.

H. HVAC Maintenance Data and Operating Instructions:
1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. 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.

I. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.5 APPLICABLE PUBLICATIONS
A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air Conditioning, Heating and Refrigeration Institute (AHRI):
   430-2009............Central Station Air-Handling Units

C. American National Standard Institute (ANSI):
   B31.1-2007............Power Piping

D. Rubber Manufacturers Association (ANSI/RMA):
   IP-20-2007............Specifications for Drives Using Classical V-Belts and Sheaves
IP-21-2009.............Specifications for Drives Using Double-V (Hexagonal) Belts
IP-22-2007.............Specifications for Drives Using Narrow V-Belts and Sheaves
E. Air Movement and Control Association (AMCA):
410-96.................Recommended Safety Practices for Air Moving Devices
F. American Society of Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code (BPVC):
Section I-2007..........Power Boilers
Section IX-2007........Welding and Brazing Qualifications
Code for Pressure Piping:
B31.1-2007.............Power Piping
A36/A36M-08..........Standard Specification for Carbon Structural Steel
E84-10..................Standard Test Method for Surface Burning Characteristics of Building Materials
H. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
SP-58-2009.............Pipe Hangers and Supports-Materials, Design and Manufacture, Selection, Application, and Installation
SP 69-2003.............Pipe Hangers and Supports-Selection and Application
SP 127-2001.............Bracing for Piping Systems, Seismic - Wind - Dynamic, Design, Selection, Application
I. National Electrical Manufacturers Association (NEMA):
MG-1-2009...............Motors and Generators
J. National Fire Protection Association (NFPA):
31-06..................Standard for Installation of Oil-Burning Equipment
54-09..................National Fuel Gas Code
70-08..................National Electrical Code
1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:
1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Resident Engineer. Such repair or replacement shall be at no additional cost to the Government.
3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:
1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Government.
4. Boilers shall be left clean following final internal inspection by Government insurance representative or inspector.
5. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.7 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 medical center.
B. Maintenance of Service: Schedule all work to permit continuous service as required by the medical center.

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 Resident Engineer during periods when the demands are not critical to the operation of the medical center. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least one week advance notice to the Resident Engineer.

D. Phasing of Work: Comply with all requirements shown on drawings or specified.

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. No storm water or ground water leakage permitted. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA.

F. Acceptance of Work for Government Operation: As new facilities are made available for operation and these facilities are of beneficial use to the Government, inspections will be made and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

G. Temporary Facilities: Refer to Article, TEMPORARY PIPING AND EQUIPMENT in this section.

**PART 2 - PRODUCTS**

**2.1 FACTORY-ASSEMBLED PRODUCTS**

A. Provide maximum standardization of components to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

   1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT
Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 LIFTING ATTACHMENTS
Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.4 EQUIPMENT AND MATERIALS IDENTIFICATION
A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. 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 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
C. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

D. Valve Tags and Lists:
1. HVAC and Boiler Plant: Provide for all valves other than for equipment in Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.
2. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
4. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

2.5 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Vibration Isolators: Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

B. Supports for Roof Mounted Items:
1. Equipment: Equipment rails shall be galvanized steel, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory installed 50 mm by 100 mm (2 by 4) treated wood nailer, 1.3 mm (18 gauge) galvanized steel counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 280 mm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.
2. Pipe/duct pedestals: Provide a galvanized Unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.

C. Pipe Supports: Comply with MSS SP-58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting requirements.

D. Attachment to Concrete Building Construction:
1. Concrete insert: MSS SP-58, Type 18.
2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (four inches) thick when approved by the Resident Engineer for each job condition.

3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the Resident Engineer for each job condition.

E. Attachment to Steel Building Construction:
1. Welded attachment: MSS SP-58, Type 22.
2. Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23mm (7/8-inch) outside diameter.

G. Attachment to existing structure: Support from existing floor/roof frame.

H. Attachment to Wood Construction: Wood screws or lag bolts.

I. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

J. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.

1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

K. Supports for Piping Systems:
1. Select hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
2. Piping Systems except High and Medium Pressure Steam (MSS SP-58):
   a. Standard clevis hanger: Type 1; provide locknut.
   b. Riser clamps: Type 8.
   c. Wall brackets: Types 31, 32 or 33.
   d. Roller supports: Type 41, 43, 44 and 46.
   e. Saddle support: Type 36, 37 or 38.
   f. Turnbuckle: Types 13 or 15. Preinsulate.
   g. U-bolt clamp: Type 24.
   h. Copper Tube:
      1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non adhesive isolation tape to prevent electrolysis.
      2) For vertical runs use epoxy painted or plastic coated riser clamps.
      3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
      4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
   i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.
3. High and Medium Pressure Steam (MSS SP-58):
   a. Provide eye rod or Type 17 eye nut near the upper attachment.
   b. Piping 50 mm (2 inches) and larger: Type 43 roller hanger. For roller hangers requiring seismic bracing provide a Type 1 clevis hanger with Type 41 roller attached by flat side bars.
   c. Piping with Vertical Expansion and Contraction:
      1) Movement up to 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.
4. Convertor and Expansion Tank Hangers: May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers.
L. Pre-insulated Calcium Silicate Shields:
1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.

2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.

3. Shield thickness shall match the pipe insulation.

4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
   a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 1 inch past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
   b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

M. Seismic Restraint of Piping and Ductwork: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Comply with MSS SP-127.

2.6 PIPE PENETRATIONS

A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.

B. To prevent accidental liquid spills from passing to a lower level, provide the following:
   1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
   2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
   3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Resident Engineer.
D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.

F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.

G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.7 ASBESTOS

Materials containing asbestos are not permitted.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Submit the drawings for review as required by Part 1. Follow manufacturer's published recommendations for installation methods not otherwise specified.
B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.

C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Cutting Holes:
   1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by Resident Engineer where working area space is limited.
   2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by Resident Engineer. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to Resident Engineer for approval.
   3. Do not penetrate membrane waterproofing.

F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.

G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

H. Electrical and Pneumatic Interconnection of Controls and Instruments: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.

I. Protection and Cleaning:
1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.

2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

J. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

K. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

L. Install steam piping expansion joints as per manufacturer’s recommendations.

M. Work in Existing Building:
   1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
   2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
   3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Resident Engineer. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Resident Engineer for determination of proper design for openings through structural
sections and opening layouts approval, prior to cutting or drilling into structure. After Resident Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.

N. Work in Animal Research Areas: Seal all pipe and duct penetrations with silicone sealant to prevent entrance of insects.

O. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak protection apparatus or other installations foreign to the electrical installation shall be located in the space equal to the width and depth of the equipment and extending from to a height of 1.8 m (6 ft.) above the equipment of to ceiling structure, whichever is lower (NFPA 70).

P. Inaccessible Equipment:
   1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost 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 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 will generally require temporary installation or relocation of equipment and piping.
   B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Paragraph 3.1 apply.
   C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.3 RIGGING
   A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.
B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Government will check structure adequacy and advise Contractor of recommended restrictions.

E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Rigging plan and methods shall be referred to Resident Engineer for evaluation prior to actual work.

G. Restore building to original condition upon completion of rigging work.

SPEC WRITER NOTE: Review the following paragraph with the project structural engineer and confirm that the structural system is adequate for piping and equipment support.

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. Drill or burn holes in structural steel only with the prior approval of the Resident Engineer.

B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.
D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-69. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.

E. HVAC Vertical Pipe Supports:
   1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
   2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.

F. Overhead Supports:
   1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
   2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
   3. Tubing and capillary systems shall be supported in channel troughs.

G. Floor Supports:
   1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Anchor and dowel concrete bases and structural systems to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
   2. Do not locate or install bases and supports until equipment mounted thereon has been approved. Size bases to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Boiler foundations shall have horizontal dimensions that exceed boiler base frame dimensions by at least 150 mm (6 inches) on all sides. Refer to structural drawings. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
   3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.
   4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
3.5 MECHANICAL DEMOLITION

A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor after approval for structural integrity by the Resident Engineer. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating facility, maintain the operation, cleanliness and safety. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Do not permit debris to accumulate in the area to the detriment of plant operation. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the VA Medical Center, and Contractor shall follow all directives of the RE or COTR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government property and shall be removed and delivered to Resident Engineer and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and
specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

SPEC WRITER NOTE: Delete the following if there is no asbestos removal.

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

3.6 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.

2. Material And Equipment Not To Be Painted Includes:
   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 shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.

4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer

5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
6. Paint shall withstand the following temperatures without peeling or discoloration:
   a. Condensate and feedwater -- 38 degrees C (100 degrees F) on insulation jacket surface and 120 degrees C (250 degrees F) on metal pipe surface.
   b. Steam -- 52 degrees C (125 degrees F) on insulation jacket surface and 190 degrees C (375 degrees F) on metal pipe surface.
7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.7 IDENTIFICATION SIGNS
   A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.
   B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.
   C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.8 COMMISSIONING
   A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
   B. Components provided under this section of the specifications will be tested as part of a larger system. Refer to Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.9 STARTUP AND TEMPORARY OPERATION
   Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.
3.10 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS and submit the test reports and records to the Resident Engineer.

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 system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.11 INSTRUCTIONS TO VA PERSONNEL

Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS, and Section 23 08 11, DEMONSTRATIONS AND TESTS FOR BOILER PLANT.

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SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION
A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:
1. Planning systematic TAB procedures.
5. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
6. Recording and reporting results.

B. Definitions:
1. Basic TAB used in this Section: Chapter 38, "Testing, Adjusting and Balancing" of 2011 ASHRAE Handbook, "HVAC Applications".
2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
5. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK
A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
C. Section 23 07 11, HVAC, AND BOILER PLANT INSULATION:
D. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS. Equipment Insulation.
E. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

1.3 QUALITY ASSURANCE
A. Refer to Articles, Quality Assurance and Submittals, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC, Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANTS AND STEAM GENERATION, and Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
B. Qualifications:
1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency’s review shows unsatisfactory work performed by the predecessor agency.

3. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.

4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Resident Engineer. The responsibilities would specifically include:
   a. Shall directly supervise all TAB work.
   b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.
   c. Would follow all TAB work through its satisfactory completion.
d. Shall provide final markings of settings of all HVAC adjustment devices.
e. Permanently mark location of duct test ports.

5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing. The lead technician shall be certified by AABC or NEBB

C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.

D. Tab Criteria:
1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 38, and requirements stated herein shall be the basis for planning, procedures, and reports.
2. Systems shall be adjusted for energy efficient operation as described in PART 3.
3. Typical TAB procedures and results shall be demonstrated to the Resident Engineer for one air distribution system (including all fans, three terminal units, three rooms randomly selected by the Resident Engineer) and one hydronic system (pumps and three coils) as follows:
   a. When field TAB work begins.
   b. During each partial final inspection and the final inspection for the project if requested by VA.

1.4 SUBMITTALS
A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
C. For use by the Resident Engineer staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.
D. Submit Following for Review and Approval:
1. Systems inspection report on equipment and installation for conformance with design.
3. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
4. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

1.5 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.

B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):

2011 ....................HVAC Applications ASHRAE Handbook, Chapter 38, Testing, Adjusting, and Balancing and Chapter 48, Sound and Vibration Control

C. Associated Air Balance Council (AABC):

2002......................AABC National Standards for Total System Balance

D. National Environmental Balancing Bureau (NEBB):


E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

3rd Edition 2002 ........HVAC SYSTEMS Testing, Adjusting and Balancing

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to TAB Criteria in Article, Quality Assurance.

B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.
3.2 SYSTEM READINESS REPORT
A. The TAB Contractor shall measure existing water flow rates associated with existing systems utilized to serve renovated areas as indicated on drawings. Submit report of findings to resident engineer.
B. Inspect each System to ensure that it is complete including installation and operation of controls. Submit report to RE in standard format and forms prepared and or approved by the Commissioning Agent.
C. Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the Resident Engineer.

3.3 TAB REPORTS
A. The TAB contractor shall provide raw data immediately in writing to the Resident Engineer if there is a problem in achieving intended results before submitting a formal report.
B. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval at no additional cost to the owner.
C. Do not proceed with the remaining systems until intermediate report is approved by the Resident Engineer.

3.4 TAB PROCEDURES
A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
B. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.
C. Water Balance and Equipment Test: Include circulating pumps, convertors, coils, coolers and condensers:
   1. Adjust flow rates for equipment. Set coils and evaporator to values on equipment submittals, if different from values on contract drawings.
   2. Primary-secondary (variable volume) systems: Coordinate TAB with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Balance systems at design water flow and then verify that variable flow controls function as designed.
3. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.

3.5 MARKING OF SETTINGS
Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Resident Engineer.

3.6 IDENTIFICATION OF TEST PORTS
The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

3.13 COMMISSIONING
A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

--- END ---
PART 1 - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for
   1. HVAC piping and equipment.

B. Definitions
   1. ASJ: All service jacket, white finish facing or jacket.
   2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
   5. FSK: Foil-scrim-kraft facing.
   6. Density: kg/m³ – kilograms per cubic meter (Pcf – pounds per cubic foot).
   7. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
      a. Flat surface: Watt per square meter (BTU per hour per square foot).
      b. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).
   9. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
   10. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.
   11. HPS: High pressure steam (415 kPa [60 psig] and above).
   12. HPR: High pressure steam condensate return.
   13. MPS: Medium pressure steam (110 kPa [16 psig] thru 414 kPa [59 psig]).
   14. MPR: Medium pressure steam condensate return.
   15. LPS: Low pressure steam (103 kPa [15 psig] and below).
   16. LPR: Low pressure steam condensate gravity return.
   17. PC: Pumped condensate.
18. R: Pump recirculation.
19. CW: Cold water.
20. SCW: Soft water.
21. HW: Hot water.
22. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK
A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
B. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
C. Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL
E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
F. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
G. Section 23 22 13, STEAM and CONDENSATE HEATING PIPING

1.3 QUALITY ASSURANCE
A. Refer to article QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
B. Criteria:
   1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:

   4.3.3.1 Pipe insulation and coverings, vapor retarder facings, adhesives, fasteners, tapes, shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.

   4.3.3.1.1 Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

   4.3.10.2.6.1 Electrical wires and cables and optical fiber cables shall be listed as noncombustible or limited combustible and have a maximum smoke developed index of 50 or shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

   4.3.10.2.6.6 Supplementary materials for air distribution systems shall be permitted when complying with the provisions of 4.3.3.

2. Test methods: ASTM E84, UL 723, or NFPA 255.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.

4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS
A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
B. Shop Drawings:
   1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
      a. Insulation materials: Specify each type used and state surface burning characteristics.
      b. Insulation accessory materials: Each type used.
      c. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
      d. Make reference to applicable specification paragraph numbers for coordination.

1.5 STORAGE AND HANDLING OF MATERIAL
Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.
1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. Federal Specifications (Fed. Spec.):
   L-P-535E (2)-99........Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

C. Military Specifications (Mil. Spec.):
   MIL-A-3316C (2)-90......Adhesives, Fire-Resistant, Thermal Insulation
   MIL-A-24179A (1)-87.....Adhesive, Flexible Unicellular-Plastic Thermal Insulation
   MIL-C-19565C (1)-88.....Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier
   MIL-C-20079H-87.........Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

D. American Society for Testing and Materials (ASTM):
   B209-07.................Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
   C411-05..................Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation
   C533-09..................Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
   C534-08..................Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
   C552-07..................Standard Specification for Cellular Glass Thermal Insulation
C553-08.................Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications


C612-10.................Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126-04.................Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-10.................Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

D1668-97a (2006)........Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-10.................Standard Test Method for Surface Burning Characteristics of Building Materials


E136-09b.................Standard Test Methods for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C (1380 F)

E. National Fire Protection Association (NFPA):
  101-09.................Life Safety Code
  251-06.................Standard methods of Tests of Fire Endurance of Building Construction Materials
  255-06.................Standard Method of tests of Surface Burning Characteristics of Building Materials

F. Underwriters Laboratories, Inc (UL):
  723.................UL Standard for Safety Test for Surface Burning Characteristics of Building Materials with Revision of 09/08

G. Manufacturer’s Standardization Society of the Valve and Fitting Industry (MSS):
  SP58-2009.................Pipe Hangers and Supports Materials, Design, and Manufacture
PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m³ (3 pcf), \( k = 0.037 \) (0.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.

B. ASTM C553 (Blanket, Flexible) Type I, Class B-5, Density 32 kg/m³ (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) with foil scrim (FSK) facing.

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, \( k = 0.037 \) (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

2.2 MINERAL WOOL OR REFRACTORY FIBER

A. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees F).

2.3 CELLULAR GLASS CLOSED-CELL

A. Comply with Standard ASTM C177, C518, density 120 kg/m³ (7.5 pcf) nominal, \( k = 0.033 \) (0.29) at 244 degrees C (75 degrees F).

B. Pipe insulation for use at temperatures up to 200 degrees C (400 degrees F) with all service vapor retarder jacket.

2.4 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:

<table>
<thead>
<tr>
<th>Insulation Characteristics</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ITEMS</strong></td>
<td>TYPE I</td>
<td>TYPE II</td>
</tr>
<tr>
<td>Temperature, maximum degrees C</td>
<td>649 (1200)</td>
<td>927 (1700)</td>
</tr>
<tr>
<td>(degrees F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density (dry), Kg/m³ (lb/ ft³)</td>
<td>232 (14.5)</td>
<td>288 (18)</td>
</tr>
<tr>
<td>Thermal conductivity:</td>
<td>0.059</td>
<td>0.078</td>
</tr>
<tr>
<td>Min W/ m K (Btu in/h ft² degrees F)@</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
mean temperature of 93 degrees C
(200 degrees F) | (0.41) | (0.540)
---|---|---
Surface burning characteristics:
Flame spread Index, Maximum | 0 | 0
Smoke Density index, Maximum | 0 | 0

### 2.5 INSULATION FACINGS AND JACkETS

A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on exposed pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.

B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

C. Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping and 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.

D. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.

E. Factory composite materials may be used provided that they have been tested and certified by the manufacturer.

F. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.
2.6 REMOVABLE INSULATION JACKETS

A. Insulation and Jacket:
   1. Non-Asbestos Glass mat, type E needled fiber.
   2. Temperature maximum of 450°F, Maximum water vapor transmission of 0.00 perm, and maximum moisture absorption of 0.2 percent by volume.
   3. Jacket Material: Silicon/fiberglass and LFP 2109 pure PTFE.
   4. Construction: One piece jacket body with three-ply braided pure Teflon or Kevlar thread and insulation sewn as part of jacket. Belt fastened.

2.7 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/m³ (3.0 pcf).

<table>
<thead>
<tr>
<th>Nominal Pipe Size mm (inches)</th>
<th>Insert Blocks mm (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up through 125 (5)</td>
<td>150 (6) long</td>
</tr>
<tr>
<td>150 (6)</td>
<td>150 (6) long</td>
</tr>
<tr>
<td>200 (8), 250 (10), 300 (12)</td>
<td>225 (9) long</td>
</tr>
<tr>
<td>350 (14), 400 (16)</td>
<td>300 (12) long</td>
</tr>
<tr>
<td>450 through 600 (18 through 24)</td>
<td>350 (14) long</td>
</tr>
</tbody>
</table>

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/m³ (3.0 pcf).

2.8 ADHESIVE, MASTIC, CEMENT

C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.
E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
G. Other: Insulation manufacturers’ published recommendations.

2.9 MECHANICAL FASTENERS
A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
B. Staples: Outward clinching monel or galvanized steel.
C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
D. Bands: 13 mm (0.5 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.10 REINFORCEMENT AND FINISHES
A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.
C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.
E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.
F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

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 Resident Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
B. Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories). 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 in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor retarder over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

E. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

F. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.

G. Insulate PRVs, flow meters, and steam traps.

H. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

I. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/fitting. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

3.2 INSULATION INSTALLATION

A. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor
retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.

2. Contractor's options for fitting, flange and valve insulation:
   a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
   b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
   c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
   d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).

3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

B. Cellular Glass Insulation:
   1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.
   2. Underground Piping Other than or in lieu of that Specified in Section 23 21 13, HYDRONIC PIPING and Section 33 63 00, STEAM ENERGY DISTRIBUTION: Type II, factory jacketed with a 3 mm laminate jacketing consisting of 3000 mm x 3000 mm (10 ft x 10 ft) asphalt impregnated glass fabric, bituminous mastic and outside protective plastic film.
      a. 75 mm (3 inches) thick for hot water piping.
      b. Provide expansion chambers for pipe loops, anchors and wall penetrations as recommended by the insulation manufacturer.

C. Calcium Silicate:
1. Minimum thickness in millimeter (inches) specified in the schedule at the end of this section for piping other than in boiler plant. See paragraphs 3.3 through 3.7 for Boiler Plant Applications.

### 3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

### 3.4 PIPE INSULATION SCHEDULE

Provide insulation for piping systems as scheduled below:

<table>
<thead>
<tr>
<th>Operating Temperature Range/Service</th>
<th>Insulation Material</th>
<th>Nominal Pipe Size</th>
<th>Insulation Thickness</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Less than 25 (1)</td>
<td>25 – 32 (1 – 1¼)</td>
<td>38 – 75 (1½ – 3)</td>
</tr>
<tr>
<td>122-177 degrees C (251-350 degrees F) (HPS, MPS)</td>
<td>Mineral Fiber (Above ground piping only)</td>
<td>75 (3)</td>
<td>100 (4)</td>
<td>113 (4.5)</td>
</tr>
<tr>
<td>93-260 degrees C (200-500 degrees F) (HPS, HPR)</td>
<td>Calcium Silicate</td>
<td>100 (4)</td>
<td>125 (5)</td>
<td>150 (6)</td>
</tr>
<tr>
<td>100-121 degrees C (212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves, Condensate receivers and flash tanks)</td>
<td>Mineral Fiber (Above ground piping only)</td>
<td>62 (2.5)</td>
<td>62 (2.5)</td>
<td>75 (3.0)</td>
</tr>
<tr>
<td>38-94 degrees C (100-200 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)</td>
<td>Mineral Fiber (Above ground piping only)</td>
<td>38 (1.5)</td>
<td>38 (1.5)</td>
<td>50 (2.0)</td>
</tr>
</tbody>
</table>
PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 23.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

1.2 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

A. This Section includes requirements for commissioning the Facility exterior closure, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.

B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 23 is part of the construction process. Documentation and testing of these systems, as well as training of the VA’s Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 23, is required in cooperation with the VA and the Commissioning Agent.

B. The Facility exterior closure systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:
1.6 SUBMITTALS

A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

A. Commissioning of HVAC systems will require inspection of individual elements of the HVAC systems construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning plan to schedule HVAC systems inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING
REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS
A. Contractor tests as required by other sections of Division 23 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days’ notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:
A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.5 TRAINING OF VA PERSONNEL
A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00. The instruction shall be scheduled in coordination with the VA Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 23 Sections for additional Contractor training requirements.

----- END -----
SECTION 23 22 13
STEAM AND CONDENSATE HEATING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION
A. Steam, condensate and vent piping inside buildings. Boiler plant and outside steam distribution piping is covered in specification Section 33 63 00, STEAM ENERGY DISTRIBUTION and Section 23 21 11, BOILER PLANT PIPING SYSTEMS.

1.2 RELATED WORK
A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
C. Section 23 07 11, HVAC, - AND BOILER PLANT INSULATION.

1.3 QUALITY ASSURANCE
A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION, which includes welding qualifications.

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. Pipe and equipment supports.
   2. Pipe and tubing, with specification, class or type, and schedule.
   3. Pipe fittings, including miscellaneous adapters and special fittings.
   4. Flanges, gaskets and bolting.
   5. Valves of all types.
   7. Pipe alignment guides.
   8. Expansion joints.
11. All specified steam system components.
13. Thermometers and test wells.
15. Seismic bracing details for piping.
C. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:
1. Heat Exchangers (Steam-to-Hot Water).
2. Flash tanks.

D. Coordination Drawings: Refer to Article, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

E. As-Built Piping Diagrams: Provide drawing as follows for steam and steam condensate piping and other central plant equipment.
1. One wall-mounted stick file for prints. Mount stick file in the chiller plant or adjacent control room along with control diagram stick file.
2. One set of reproducible drawings.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers/American National Standards Institute (ASME/ANSI):
   B1.20.1-83(R2006)........Pipe Threads, General Purpose (Inch)
   B16.4-2006..............Gray Iron Threaded Fittings

C. American Society of Mechanical Engineers (ASME):
   B16.1-2005..............Gray Iron Pipe Flanges and Flanged Fittings
   B16.3-2006..............Malleable Iron Threaded Fittings
   B16.9-2007..............Factory-Made Wrought Buttwelding Fittings
   B16.11-2005..............Forged Fittings, Socket-Welding and Threaded
   B16.14-91..............Ferrous Pipe Plugs, Bushings, and Locknuts with Pipe Threads
   B16.22-2001..............Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
   B16.23-2002..............Cast Copper Alloy Solder Joint Drainage Fittings
   B16.24-2006..............Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500
   B16.39-98..............Malleable Iron Threaded Pipe Unions, Classes 150, 250, and 300
   B31.1-2007..............Power Piping
   B31.9-2008..............Building Services Piping
   B40.100-2005.............Pressure Gauges and Gauge Attachments
Boiler and Pressure Vessel Code: SEC VIII D1-2001, Pressure Vessels, Division 1

D. American Society for Testing and Materials (ASTM):
A47-99...............Ferritic Malleable Iron Castings
A53-2007.............Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A106-2008............Seamless Carbon Steel Pipe for High-Temperature Service
A181-2006............Carbon Steel Forgings, for General-Purpose Piping
A183-2003............Carbon Steel Track Bolts and Nuts
A216-2008............Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
A285-01..............Pressure Vessel Plates, Carbon Steel, Low-and-Intermediate-Tensile Strength
A307-2007............Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
A516-2006............Pressure Vessel Plates, Carbon Steel, for Moderate-and-Lower Temperature Service
B32-2008...............Solder Metal
B61-2008...............Steam or Valve Bronze Castings
B62-2009...............Composition Bronze or Ounce Metal Castings
B88-2003...............Seamless Copper Water Tube
F439-06...............Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
F441-02(2008)........Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

E. American Welding Society (AWS):
A5.8-2004...............Filler Metals for Brazing and Braze Welding
B2.1-00...............Welding Procedure and Performance Qualifications

F. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:
SP-67-95...............Butterfly Valves
SP-70-98................Cast Iron Gate Valves, Flanged and Threaded Ends
SP-71-97................Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-72-99................Ball Valves with Flanged or Butt-Welding Ends for General Service
SP-78-98................Cast Iron Plug Valves, Flanged and Threaded Ends
SP-80-97................Bronze Gate, Globe, Angle and Check Valves
SP-85-94................Cast Iron Globe and Angle Valves, Flanged and Threaded Ends

G. Military Specifications (Mil. Spec.):

H. National Board of Boiler and Pressure Vessel Inspectors (NB): Relieving Capacities of Safety Valves and Relief Valves


PART 2 - PRODUCTS
2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES
   A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

2.2 PIPE AND TUBING
   A. Steam Piping: Steel, ASTM A53, Grade B, seamless or ERW; A106 Grade B, Seamless; Schedule 40.
   B. Steam Condensate and Pumped Condensate Piping:
      1. Concealed above ceiling, in wall or chase: Copper water tube ASTM B88, Type K, hard drawn.
      2. All other locations: Copper water tube ASTM B88, Type K, hard drawn; or steel, ASTM A53, Grade B, Seamless or ERW, or A106 Grade B Seamless, Schedule 80.
   C. Vent Piping: Steel, ASTM A53, Grade B, seamless or ERW; A106 Grade B, Seamless; Schedule 40, galvanized.

2.3 FITTINGS FOR STEEL PIPE
   A. 50 mm (2 inches) and Smaller: Screwed or welded.
      1. Butt welding: ASME B16.9 with same wall thickness as connecting piping.
      2. Forged steel, socket welding or threaded: ASME B16.11.
3. Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron, except for steam and steam condensate piping. Provide 300 pound malleable iron, ASME B16.3 for steam and steam condensate piping. Cast iron fittings or piping is not acceptable for steam and steam condensate piping. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.


5. Steam line drip station and strainer quick-couple blowdown hose connection: Straight through, plug and socket, screw or cam locking type for 15 mm (1/2 inch) ID hose. No integral shut-off is required.

B. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints.

1. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.

2. Welding flanges and bolting: ASME B16.5:
   a. Steam service: Weld neck or slip-on, raised face, with non-asbestos gasket. Non-asbestos gasket shall either be stainless steel spiral wound strip with flexible graphite filler or compressed inorganic fiber with nitrile binder rated for saturated and superheated steam service 750 degrees F and 1500 psi.
   b. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.

C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gage connections.

2.4 FITTINGS FOR COPPER TUBING

A. Solder Joint:
   1. Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.


2.5 DIELECTRIC FITTINGS

A. Provide where copper tubing and ferrous metal pipe are joined.
B. 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.
C. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.
D. Temperature Rating, 121 degrees C (250 degrees F) for steam condensate and as required for steam service.
E. Contractor’s option: On pipe sizes 2” and smaller, screwed end brass gate valves // or dielectric nipples // may be used in lieu of dielectric unions.

2.6 SCREWED JOINTS
B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.7 VALVES
A. Asbestos packing is not acceptable.
B. All valves of the same type shall be products of a single manufacturer.
C. Provide chain operators for valves 150 mm (6 inches) and larger when the centerline is located 2100 mm (7 feet) or more above the floor or operating platform.
D. Shut-Off Valves
   1. Gate Valves:
      a. 50 mm (2 inches) and smaller: MSS-SP80, Bronze, 1034 kPa (150 lb.), wedge disc, rising stem, union bonnet.
      b. 65 mm (2 1/2 inches) and larger: Flanged, outside screw and yoke.
         1) High pressure steam 413 kPa (60 psig) and above nominal MPS system: Cast steel body, ASTM A216 grade WCB, 1034 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel solid disc and seats. Provide 25 mm (1 inch) factory installed bypass with globe valve on valves 100 mm (4 inches) and larger.
         2) All other services: MSS-SP 70, iron body, bronze mounted, 861 kPa (125 psig) wedge disc.
   E. Globe and Angle Valves:
      1. Globe Valves:
         a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Globe valves shall be union bonnet with metal plug type disc.
         b. 65 mm (2 1/2 inches) and larger:
1) Globe valves for high pressure steam 413 kPa (60 psig) and above nominal MPS system: Cast steel body, ASTM A216 grade WCB, flanged, OS&Y, 1034 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.

2) All other services: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for globe valves.

2. Angle Valves
   a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Angle valves shall be union bonnet with metal plug type disc.
   b. 65 mm (2 1/2 inches) and larger:
      1) Angle valves for high pressure steam 413 kPa (60 psig) and above nominal MPS system: Cast steel body, ASTM A216 grade WCB, flanged, OS&Y, 1034 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.
      2) All other services: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for angle valves.

F. Swing Check Valves
   1. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 psig), 45 degree swing disc.
   2. 65 mm (2-1/2 inches) and Larger:
      a. Check valves for high pressure steam 413 kPa (60 psig) and above nominal MPS system: Cast steel body, ASTM A216 grade WCB, flanged, OS&Y, 1034 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.
      b. All other services: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-71 for check valves.


2.8 STRAINERS

A. Basket or Y Type. Tee type is acceptable for gravity flow and pumped steam condensate service.

B. High Pressure Steam: Rated 1034 kPa (150 psig) saturated steam.
   1. 50 mm (2 inches) and smaller: Iron, ASTM A116 Grade B, or bronze, ASTM B-62 body with screwed connections (250 psig).
2. 65 mm (2-1/2 inches) and larger: Flanged cast steel or 1723 kPa (250 psig) cast iron.

C. All Other Services: Rated 861 kPa (125 psig) saturated steam.
   1. 50 mm (2 inches) and smaller: Cast iron or bronze.
   2. 65 mm (2-1/2 inches) and larger: Flanged, iron body.

D. Screens: Bronze, monel metal or 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows:
   1. 75 mm (3 inches) and smaller: 20 mesh for steam and 1.1 mm (0.045 inch) diameter perforations for liquids.
   2. 100 mm (4 inches) and larger: 1.1 mm (0.045) inch diameter perforations for steam and 3.2 mm (0.125 inch) diameter perforations for liquids.

2.9 PIPE ALIGNMENT

A. Guides: Provide factory-built guides along the pipe line to permit axial movement only and to restrain lateral and angular movement. Guides must be designed to withstand a minimum of 15 percent of the axial force which will be imposed on the expansion joints and anchors. Field-built guides may be used if detailed on the contract drawings.

2.10 EXPANSION JOINTS

A. Factory built devices, inserted in the pipe lines, designed to absorb axial cyclical pipe movement which results from thermal expansion and contraction. This includes factory-built or field-fabricated guides located along the pipe lines to restrain lateral pipe motion and direct the axial pipe movement into the expansion joints.

B. Minimum Service Requirements:
   1. Pressure Containment:
      a. Steam Service 35-200 kPa (5-30 psig): Rated 345 kPa (50 psig) at 148 degrees C (298 degrees F).
      b. Steam Service 214-850 kPa (31-125 psig): Rated 1025 kPa (150 psig) at 186 degrees C (366 degrees F).
      c. Steam Service 869-1025 kPa (126-150 psig): Rated 1375 kPa (200 psig) at 194 degrees C (382 degrees F).
      d. Condensate Service: Rated 690 kPa (100 psig) at 154 degrees C (310 degrees F).
   2. Number of Full Reverse Cycles without failure: Minimum 1000.
   3. Movement: As shown on drawings plus recommended safety factor of manufacturer.
C. Manufacturing Quality Assurance: Conform to Expansion Joints Manufacturers Association Standards.

D. Bellows - Internally Pressurized Type:
1. Multiple corrugations of Type 304 or Type A240-321 stainless steel.
2. Internal stainless steel sleeve entire length of bellows.
3. External cast iron equalizing rings for services exceeding 340 kPa (50 psig).
5. Design shall conform to standards of EJMA and ASME B31.1.
6. External tie rods designed to withstand pressure thrust force upon anchor failure if one or both anchors for the joint are at change in direction of pipeline.
7. Integral external cover.

E. Bellows - Externally Pressurized Type:
1. Multiple corrugations of Type 304 stainless steel.
2. Internal and external guide integral with joint.
3. Design for external pressurization of bellows to eliminate squirm.
6. Threaded connection at bottom, 25 mm (one inch) minimum, for drain or drip point.
7. Integral external cover and internal sleeve.

F. Expansion Joint Identification: Provide stamped brass or stainless steel nameplate on each expansion joint listing the manufacturer, the allowable movement, flow direction, design pressure and temperature, date of manufacture, and identifying the expansion joint by the identification number on the contract drawings.

2.11 FLEXIBLE BALL JOINTS
A. Design and Fabrication: One piece component construction, fabricated from steel with welded ends, designed for a working steam pressure of 1720 kPa (250 psig) and a temperature of 232 degrees C (450 degrees F). Each joint shall provide for 360 degrees rotation in addition to a minimum angular flexible movement of 30 degrees for sizes 6 mm (1/4 inch) to 150 mm (6 inch) inclusive, and 15 degrees for sizes 65 mm (2-1/2 inches) to 750 mm (30 inches). Joints through 350 mm (14 inches) shall have forged pressure retaining members; while size 400 mm (16 inches) through 760 mm (30 inches) shall be of one piece construction.
B. Material:
1. Cast or forged steel pressure containing parts and bolting in accordance with Section II of the ASME Boiler Code or ASME B31.1. Retainer may be ductile iron ASTM A536, Grade 65-45-12, or ASME Section II SA 515, Grade 70.
2. Gaskets: Steam pressure molded composition design for a temperature range of from minus 10 degrees C (50 degrees F) to plus 274 degrees C (525 degrees F).

C. Certificates: Submit qualifications of ball joints in accordance with the following test data:
1. Low pressure leakage test: 41 kPa (6psig) saturated steam for 60 days.
2. Flex cycling: 800 Flex cycles at 3445 kPa (500 psig) saturated steam.
3. Thermal cycling: 100 saturated steam pressure cycles from atmospheric pressure to operating pressure and back to atmospheric pressure.
4. Environmental shock tests: Forward certificate from a recognized test laboratory, that ball joints of the type submitted has passed shock testing in accordance with Mil. Spec MIL-S-901.
5. Vibration: 170 hours on each of three mutually perpendicular axis at 25 to 125 Hz; 1.3 mm to 2.5 mm (0.05 inch to 0.1 inch) double amplitude on a single ball joint and 3 ball joint off set.

2.12 STEAM SYSTEM COMPONENTS
A. Heat Exchanger (Steam to Hot Water): Shell and tube type, U-bend removable tube bundle, steam in shell, water in tubes, equipped with support cradles.
1. Maximum tube velocity: 2.3 m/s (7.5 feet per second).
2. Tube fouling factor: TEMA Standards, but not less than 0.00018 m²K/W (0.001 ft²hrF/Btu).
3. Materials:
   a. Shell: Steel.
   b. Tube sheet and tube supports: Steel or brass.
   c. Tubes: 20 mm (3/4 inch) OD copper.
   d. Head or bonnet: Cast iron or steel.
B. Optional Heat Transfer Package: In lieu of field erected individual components, the Contractor may provide a factory or shop assembled package of heat exchangers, pumps, and other components supported on a welded steel frame.

C. Steam Pressure Reducing Valves in PRV Stations:
1. Type: Single-seated, diaphragm operated, spring-loaded, external or internal steam pilot-controlled, normally closed, adjustable set pressure. Pilot shall sense controlled pressure downstream of main valve.
2. Service: Provide controlled reduced pressure to steam piping systems.
3. Pressure control shall be smooth and continuous with maximum drop of 10 percent. Maximum flow capability of each valve shall not exceed capacity of downstream safety valve(s).
4. Main valve and pilot valve shall have replaceable valve plug and seat of stainless steel, monel, or similar durable material.
   a. Pressure rating for high pressure steam: Not less than 1034 kPa (150 psig) saturated steam.
   b. Connections: Flanged for valves 65 mm (2-1/2 inches) and larger; flanged or threaded ends for smaller valves.
5. Select pressure reducing valves to develop less than 85 dbA at 1500 mm (5 feet) elevation above adjacent floor, and 1500 mm (5 feet) distance in any direction. Inlet and outlet piping for steam pressure reducing valves shall be Schedule 80 minimum for required distance to achieve required levels or sound attenuators shall be applied.

D. Safety Valves and Accessories: Comply with ASME Boiler and Pressure Vessel Code, Section VIII. Capacities shall be certified by National Board of Boiler and Pressure Vessel Inspectors, maximum accumulation 10 percent. Provide lifting lever. Provide drip pan elbow where shown.

G. Steam Trap: Each type of trap shall be the product of a single manufacturer. Provide trap sets at all low points and at 61 m (200 feet) intervals on the horizontal main lines.
1. Floats and linkages shall provide sufficient force to open trap valve over full operating pressure range available to the system. Unless otherwise indicated on the drawings, traps shall be sized for capacities indicated at minimum pressure drop as follows:
a. For equipment with modulating control valve: 1.7 kPa (1/4 psig), based on a condensate leg of 300 mm (12 inches) at the trap inlet and gravity flow to the receiver.
b. For main line drip trap sets and other trap sets at steam pressure: Up to 70 percent of design differential pressure. Condensate may be lifted to the return line.

2. Trap bodies: Bronze, cast iron, or semi-steel, constructed to permit ease of removal and servicing working parts without disturbing connecting piping, (4 bolt raised face flange). For systems without relief valve traps shall be 5. Mechanism: Brass, stainless steel or corrosion resistant alloy rated for the pressure upstream of the PRV supplying the system.

3. Balanced pressure thermostatic elements: Phosphor bronze, stainless steel or monel metal.

4. Valves and seats: Suitable hardened corrosion resistant alloy.


7. Inverted bucket traps: Provide bi-metallic thermostatic element for rapid release of non-condensables.

2.13 GAGES, PRESSURE AND COMPOUND

A. ASME B40.1, Accuracy Grade 1A, (pressure, vacuum, or compound), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 115 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.

B. Provide brass, lever handle union cock. Provide brass/bronze pressure snubber for gages in water service. Provide brass pigtail syphon for steam gages.

C. Range of Gages: For services not listed provide range equal to at least 130 percent of normal operating range:

<table>
<thead>
<tr>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low pressure steam and steam condensate</td>
<td>0 to 207 kPa (30 psig).</td>
</tr>
<tr>
<td>to 103 kPa (15 psig)</td>
<td></td>
</tr>
<tr>
<td>Medium pressure steam and steam condensate</td>
<td>0 to 689 kPa (100 psig).</td>
</tr>
<tr>
<td>nominal 413 kPa (60 psig)</td>
<td></td>
</tr>
<tr>
<td>High pressure steam and steam condensate</td>
<td>0 to 1378 kPa (200 psig).</td>
</tr>
<tr>
<td>nominal 620 kPa to 861 kPa (90 to 125 psig)</td>
<td></td>
</tr>
<tr>
<td>Pumped condensate, steam condensate, gravity or</td>
<td>0 to 415 kPa (60 psig).</td>
</tr>
<tr>
<td>vacuum</td>
<td></td>
</tr>
</tbody>
</table>
2.14 PRESSURE/TEMPERATURE TEST PROVISIONS

A. Provide one each of the following test items to the Resident Engineer:
   1. 6 mm (1/4 inch) FPT by 3 mm (1/8 inch) diameter stainless steel pressure gage adapter probe for extra long test plug. PETE'S 500 XL is an example.
   2. 90 mm (3-1/2 inch) diameter, one percent accuracy, compound gage, 762 mm (30 inches) Hg to 689 kPa (100 psig) range.
   3. 0 - 104 degrees C (32-220 degrees F) pocket thermometer one-half degree accuracy, 25 mm (one inch) dial, 125 mm (5 inch) long stainless steel stem, plastic case.

2.15 FIRESTOPPING MATERIAL

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

PART 3 - EXECUTION

3.1 GENERAL

A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

C. Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION. Install convertors and other heat exchangers at height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.

D. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope steam,
condensate and drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.

E. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

F. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.

G. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.

H. Connect piping to equipment as shown on the drawings. Install components furnished by others such as:
   1. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.

I. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, HVAC, and BOILER PLANT INSULATION.

J. Where copper piping is connected to steel piping, provide dielectric connections.

K. Pipe vents to the exterior. Where a combined vent is provided, the cross sectional area of the combined vent shall be equal to sum of individual vent areas. Slope vent piping one inch in 40 feet (0.25 percent) in direction of flow. Provide a drip trap elbow on relief valve outlets if the vent rises to prevent backpressure. Terminate vent minimum 0.3 M (12 inches) above the roof or through the wall minimum 2.5 M (8 feet) above grade with down turned elbow.

3.2 PIPE JOINTS

A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder’s qualification requirements under "Quality
Assurance" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

B. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

C. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

3.3 EXPANSION JOINTS (BELLOWS AND SLIP TYPE)

A. Anchors and Guides: Provide type, quantity and spacing as recommended by manufacturer of expansion joint and as shown. A professional engineer shall verify in writing that anchors and guides are properly designed for forces and moments which will be imposed.

B. Cold Set: Provide setting of joint travel at installation as recommended by the manufacturer for the ambient temperature during the installation.

C. Preparation for Service: Remove all apparatus provided to restrain joint during shipping or installation. Representative of manufacturer shall visit the site and verify that installation is proper.

D. Access: Expansion joints must be located in readily accessible space. Locate joints to permit access without removing piping or other devices. Allow clear space to permit replacement of joints and to permit access to devices for inspection of all surfaces and for adding packing.

3.4 STEAM TRAP PIPING

A. Install to permit gravity flow to the trap. Provide gravity flow (avoid lifting condensate) from the trap where modulating control valves are used. Support traps weighing over 11 kg (25 pounds) independently of connecting piping.

3.5 SEISMIC BRACING

A. Provide is accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.//

3.6 LEAK TESTING

A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Resident Engineer in accordance with the specified requirements. Testing shall be performed in accordance with the specification requirements.
B. An operating test at design pressure, and for hot systems, design maximum temperature.

C. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Avoid excessive pressure on mechanical seals and safety devices.

3.7 FLUSHING AND CLEANING PIPING SYSTEMS

A. Steam, Condensate and Vent Piping: No flushing or chemical cleaning required. Accomplish cleaning by pulling all strainer screens and cleaning all scale/dirt legs during start-up operation.

3.8 OPERATING AND PERFORMANCE TEST AND INSTRUCTION

A. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

B. Adjust red set hand on pressure gages to normal working pressure.

--- END ---
PART 1 - GENERAL

1.1 DESCRIPTION
A. This Section includes the following for the advanced metering of the systems of the facility. The metered systems include the electrical power, natural gas distribution, fuel gas and fuel oil, steam, steam condensate, chilled water, heating water, domestic water, recovered water and makeup water systems. The metering systems in each facility are part of a Corporate-Wide utility metering system, rendering the VA accurate and automated metering of its facilities’ energy and water flows. Metering systems are comprised of:
1. PC-based workstation(s) or server(s) and software.
2. Communication network and interface modules for Modbus TCP/IP, IEEE 802.3 data transmission protocols.
3. Electric meters.
4. Volumetric flowmeters, temperature sensors and pressure transducers.
5. Mass flowmeters.

1.2 RELATED WORK
A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of nonstructural components.
B. Section 22 05 19 METERS AND GAGES FOR PLUMBING PIPING: meters and gages.
C. Section 22 35 00 DOMESTIC WATER HEATER EXCHANGERS: references meters.
D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION: General mechanical requirements, common to more than one section in mechanical.
E. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Flowmeters and communications
F. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
G. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage cable.

1.3 DEFINITIONS
A. AMR: Automatic meter reading is the technology of automatically collecting consumption, diagnostic, and status data from water and
energy metering devices (water, gas, electric, steam) and transferring that data to a central database for billing, troubleshooting, and analyzing.

B. AUMS: Advanced Utility Metering System: the system described by this Section.

C. BACnet: BACnet is a Data Communications Protocol for Building Automation and Control Networks. It is defined by ASHRAE/ANSI Standard 135 (ISO 16484-5) standard protocol.

D. Data Over Cable Service Interface Specification (DOCSIS): an international standard defining communications and operation support interface requirements for a data over cable system, by the Cable Television Laboratories, Inc. consortium.

E. Data Head (on meters): converts analog and pulse signals to digital signals for transmission to the Site Data Aggregation Device. Also provides for limited storage of the digital signals.

F. Device Accuracy: accuracy in this section is based on actual flow, not full scale or full range. Device accuracy measures the conversion of flow information to analog or pulse signals.

G. Ethernet: Local area network, based on IEEE 802.3 standards.

H. Firmware: Software (programs or data) that has been written onto read-only memory (ROM). Firmware is a combination of software and hardware. Storage media with ROMs that have data or programs recorded on them are firmware.

I. Gateway: Bi-directional protocol translator connecting control systems that use different communication protocols.

J. GB: gigabyte. When used to describe data storage, "GB" represents 1024 megabytes.

K. HTML: Hypertext markup language.

L. I/O: Input/output.

M. KB: Short for kilobyte. When used to describe data storage, "KB" represents 1024 bytes.

N. KY Pulse: A term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay changing status in response to the rotation of the disk in the meter.

O. LAN: Local area network. Sometimes plural as "LANs."

P. LCD: Liquid crystal display.

Q. LonMark: An association comprising of suppliers and installers of LonTalk products. The Association provides guidelines for the
implementation of the LonTalk protocol to ensure interoperability through Standard implementation.

R. LonTalk: An open standard protocol developed by the Echelon Corporation that uses a "Neuron Chip" for communication.

S. LonWorks: Network technology developed by the Echelon Corporation.

T. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less that 50 V or remote-control, signaling and power-limited circuits.

U. MB: megabyte. When used to describe data storage, "MB" represents 1024 kilobytes.

V. Mbps: Megabytes per second, equal to 8 megabits per second

W. Modbus TCP/IP: An open protocol for exchange of process data.

X. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

Y. OTDR: Optical Time Domain Reflectometer. A test instrument that analyzes the light loss in an optical fiber. Used to find faults, splices and bends in the line, it works by sending out a light pulse and measuring its reflection. Such devices can measure fiber lines that are longer than 150 miles

Z. PC: Personal computer

AA.PICS, Protocol Implementation Conformance Statement: A written document that identifies the particular options specified by BACnet that are implemented in a device.

BB.REO: Resident Engineer Office: the VA office administering the construction contract.

CC.Reporting Accuracy: this is the root-mean-square sum of all of the metering devices’ inaccuracies: measurement inaccuracy, mechanical inaccuracy, analog-to-digital or pulse integration inaccuracy, etc., up to the meter’s data head.

DD.rms: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.

EE.Router: A device that connects two or more networks at the network layer.


HH. TB: terrabyte. When used to describe data storage, "TB" represents 1024 gigabytes.

II. TCP/IP: Transport control protocol/internet protocol.

JJ. Turn-down: the maximum flow divided by the minimum flow through a meter; used along with accuracy requirements. For example, a meter shall be accurate to within 2% of actual flow with throughout a 20:1 turndown.

KK. THD: Total harmonic distortion.

LL. UPS: Uninterruptible power supply; used both in singular and plural context.

MM. UTP: Unshielded twisted pair cabling, used to limit crosstalk and electromagnetic interference from the environment.

NN. WAN: Wide area network.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer Qualifications: A firm experienced at least three years in manufacturing and installing power monitoring and control equipment similar to that indicated for this Project and with a record of successful in-service performance.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency, and marked for intended use.

D. System Modifications: Make recommendations for system modification in writing to the VA. No system modifications shall be made without prior written approval of the VA. Any modifications made to the system shall be incorporated into the Operations and Maintenance Instructions, and other documentation affected. Provide to the VA software updates for all software furnished under this specification during this contract’s construction and verification periods and for the first two years after government acceptance. All updated software shall be verified as part of this contract.

1.5 PERFORMANCE

A. The advanced utility metering system shall conform to the following:
1. Site Data Aggregation Device Graphic Display: The system shall display up to 4 graphics on a single screen with a minimum of (20) dynamic points per graphic. All current data shall be displayed within (10) seconds of the request.

2. Site Data Aggregation Device Graphic Refresh: The system shall update all dynamic points with current data within ten seconds. Data refresh shall be automatic, without operator intervention.

3. Meter Scan: All changes of metered values shall be transmitted over the high-speed network such that any data used or displayed at a controller or Site Data Aggregation Device will be current, within the prior ten seconds.

4. Alarm Response Time: The maximum time from when meter goes into alarm to when it is annunciated at the workstation shall not exceed ten seconds.

5. Reporting Accuracy: Listed below are minimum acceptable reporting accuracies for all values within the below minimum turn-down envelope reported by the meters:

<table>
<thead>
<tr>
<th>Measured Variable</th>
<th>Units Measured</th>
<th>Minimum Turn-Down of Meter</th>
<th>Reporting Accuracy (Note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam</td>
<td>kW (MBH)</td>
<td>20:1</td>
<td>±2%</td>
</tr>
<tr>
<td>Domestic Water flow</td>
<td>1/s (GPH)</td>
<td>20:1</td>
<td>±2%</td>
</tr>
</tbody>
</table>

Table 1.5: Meter Performance Criteria

Table Notes:
1. This table shows reporting accuracy, not merely the meter’s accuracy. Reporting accuracy includes meter accuracy and data conversion accuracy. See Article 1.3 in this Section for definition. Accuracy is shown against the measured value, not against the full range of the meter.
2. l/s: liter per second
   CFH: cubic feet per hour
   kW: kilowatt
   MBH: 1000’s British Thermal Units per hour
   GPH: gallons per hour

1.6 WARRANTY

A. Labor and materials for advanced utility metering systems shall be warranted for a period as specified under Warranty in FAR clause 52.246-21.

B. Advance utility metering 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 metering devices.

1.7 SUBMITTALS

A. Product Data: for each type of product indicated, Attach copies of approved Product Data submittals for products (such as flowmeters, temperature sensors and pressure transmitters, switchboards and switchgear) that describe advance utility metering features to illustrate coordination among related equipment and utility metering and control.

B. Shop Drawings: include plans, elevations, sections, details, and attachments to other work.
1. Outline Drawings: Indicate arrangement of meters, components and clearance and access requirements. Clearly identify system components, internal connections, and all field connections.
2. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Wiring Diagrams: Power, signal, and communications wiring. Coordinate nomenclature and presentation with a block diagram. Show all communications network components and include a communications single-line diagram indicating device interconnection and addressing information for all system devices. Identify terminal blocks used for interconnections and wire type to be used.

C. Software and Firmware Operational Documentation:
1. Self-study guide describing the process for setting equipment's network address; setting Owner's options; procedures to ensure data access from any PC on the network, using a standard Web browser; and recommended firewall setup.
2. Software operating and upgrade manuals.
3. Software Backup: On a compact disc, complete with Owner-selected options.
4. Device address list and the set point of each device and operator option, as set in applications software.
5. Graphic file and printout of graphic screens and related icons, with legend.
6. "Quick-Start" guide to describe a simple, three-step commissioning process for setting the equipment’s Ethernet address, and ensuring
trouble-free data access from any PC on the network, using a standard web browser.

D. Software Upgrade Kit: For Owner to use in modifying software to suit future utility metering system revisions.

E. Firmware Upgrade Kit: For Owner to use in modifying firmware to suit future power system revisions or advanced utility metering system revisions. Firmware updates, and necessary software tools for firmware updates, shall be downloadable from the internet. VA shall be able to update firmware, in equipment, without removing device from the equipment. VA shall be capable of updating firmware over the utility metering communication network or through local communication ports on the device.

F. Software licenses and upgrades required by and installed for operating and programming digital and analog devices.

G. Qualification Data: For installer and manufacturer

H. Other Informational Submittals:
   1. System installation and setup guides, with data forms to plan and record options and setup decisions.

I. Revise and update the Contract Drawings to include details of the system design. Drawings shall be on 17 by 11 inches sheets. Details to be shown on the Design Drawing include:
   1. Details on logical structure of the network. This includes logical location of all network hardware.
   2. Manufacturer and model number for each piece of computer and network hardware.
   3. Physical location for each piece of network or computer hardware.
   4. Physical routing of LAN cabling.
   5. Physical and qualitative descriptions of connectivities.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For advanced utility metering system components and meters, to include in emergency, operation, and maintenance manuals. Include the following:
   1. Operating and applications software documentation.
   2. Software licenses.
   3. Software service agreement.
   4. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include
system restore, emergency boot compact disks, and drivers for all installed hardware. Provide separately for each PC.

5. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.

6. In addition to the copies required by 01 00 00, provide 5 bound paper copies of the Operation and Maintenance Data and two compact disks (CD), with all Instructions as Acrobat PDF files. The pdf files shall identical to the paper copies and shall Acrobat navigation tools including Bookmarks for each Chapter.

7. The advanced utility metering system Operation and Maintenance Instructions shall include:
   a. Procedures for the AUMS system start-up, operation and shut-down.
   b. Final As-Built drawings, including actual LAN cabling routing shown on architectural backgrounds.
      1) IP address(es) as applicable for each piece of network hardware.
      2) IP address for each computer server, workstation and networked printer.
      3) Network identifier (name) for each printer, computer server and computer workstation.
      4) CEA-709.1B address (domain, subnet, node address) for each CEA-709.1B TP/FT-10 to IP Router.
   c. Routine maintenance checklist, rendered in a Microsoft Excel format. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all installed devices, the second column shall list each device’s node identifier/address, the third column shall describe each device’s physical location, the fourth column shall state the maintenance activity or state no maintenance required, the fifth column shall state the frequency of the maintenance activity, frequency of calibration and the sixth column for additional comments or reference.
   d. Qualified service organization list.
   e. In addition to the requirements in Section 01 33 23, the submittal shall include manufacturer Installation Requirements.
   f. Include complete instructions for calibration of each meter type and model.
g. Start-Up and Start-Up Testing Report.
h. Performance verification test procedures and reports.
i. Preventive Maintenance Work Plan.
j. In addition to factory-trained manufacturers' representatives requirements in 01 00 00, provide signed letter by factory-trained manufacturers' representatives stating that the system and components are installed in strict accordance with the manufacturers’ recommendations.

B. Field quality-control test reports.

1.9 LICENSING AGREEMENT

A. Licenses procured as part of this work become the property of the government upon acceptance of the work. Licenses shall have no expiration.

B. Technical Support: Beginning with Government Acceptance, provide software support for //one// //two// //Insert number// years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Government Acceptance. Upgrading software shall include the operating systems. Upgrade shall include new or revised licenses for use of software.

1. Provide 30-day notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.10 MAINTENANCE AND SERVICE

A. Preventive Maintenance Requirements: provide a preventative maintenance plan with attached procedures indicated by meter and component manufacturers. Perform maintenance procedures for a period of 1 year after government acceptance, at frequencies and using procedures required by the meter and component manufacturers. At a minimum and if the manufacturer is silent on its preventative maintenance requirements, frequencies, deliverables and activities shall comply with the following:

1. Preventive Maintenance Work Plan: prepare a Preventive Maintenance Work Plan to schedule all required preventive maintenance. VA approval of the Work Plan shall be obtained. Adhere to the approved work plan to facilitate VA verification of work. If the Contractor finds it necessary to reschedule maintenance, a written request shall be made to the VA detailing the reasons for the proposed
change at least five days prior to the originally scheduled date. Scheduled dates shall be changed only with the prior written approval of the REO.

2. Semiannual Maintenance: perform the following Semiannual Maintenance as specified:
   a. Perform data backups on all Server Hardware.
   b. Run system diagnostics and correct diagnosed problems.
   c. Perform fan checks and filter changes for AUMS hardware.
   d. Perform all necessary adjustments on printers.
   e. Resolve all outstanding problems.
   f. Install new ribbons, ink cartridges and toner cartridges into printers, and ensure that there is at least one spare ribbon or cartridge located at each printer.

3. Maintenance Procedures
   a. Maintenance Coordination: Any scheduled maintenance event by Contractor that will result in component downtime shall be coordinated with the VA as follows. Time periods shall be measured as actual elapsed time from beginning of equipment off-line period, including working and non-working hours.
      1) For non-redundant computer server hardware, provide 14 days notice, components shall be off-line for no more than 8 hours.
      2) For redundant computer server hardware, provide 7 days notice, components shall be off-line for no more than 36 hours.
      3) For active (powered) network hardware, provide 14 days notice, components shall be off-line for no more than 6 hours.
      4) For cabling and other passive network hardware, provide 21 days notice, components shall be off-line for no more than 12 hours.
   b. Software/Firmware: Software/firmware maintenance shall include operating systems, application programs, and files required for the proper operation of the advanced utility metering system regardless of storage medium. User- (project site-) developed software is not covered by this contract, except that the advanced utility metering system software/firmware shall be maintained to allow user creation, modification, deletion, and proper execution of such user-developed software as specified. Perform diagnostics and corrective reprogramming as required to maintain total advanced utility metering system operations as
specified. Back up software before performing any computer hardware and software maintenance. Do not modify any parameters without approval from the VA. Any approved changes and additions shall be properly documented, and the appropriate manuals shall be updated.

c. Network: Network maintenance shall include testing transmission media and equipment to verify signal levels, system data rates, errors and overall system performance.

B. Service Call Reception

1. A VA representative will advise the Contractor by phone or in person of all maintenance and service requests, as well as the classification of each based on the definitions specified. A description of the problem or requested work, date and time notified, location, classification, and other appropriate information will be placed on a Service Call Work Authorization Form by the VA.

2. The Contractor shall have procedures for receiving and responding to service calls during regular working hours. A single telephone number shall be provided for receipt of service calls during regular working hours. Service calls shall be considered received by the Contractor at the time and date the telephone call is placed by the VA.

3. Separately record each service call request, as received on the Service Call Work Authorization form. Complete the Service Call Work Authorization form for each service call. The completed form shall include the serial number identifying the component involved, its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion.

4. Respond to each service call request within two working hours. The status of any item of work must be provided within four hours of the inquiry during regular working hours, and within sixteen hours after regular working hours or as needed to repair equipment.
1.11 SPARE PARTS
A. Furnish spare parts described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Addressable Relays: One for every ten installed. Furnish at least one of each type.
   2. Data Line Surge Suppressors: One for every ten of each type installed. Furnish at least one of each type.
B. Furnish spare parts shall not be used for any warranty-required remediation.

1.12 APPLICABLE PUBLICATIONS
A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced, unless otherwise noted. Publications are referenced in the text by the basic designation only.
B. American Society of Mechanical Engineers (ASME):
   B31.1-2007..............Power Piping
   B31.8-2007..............Gas Transmission and Distribution Piping Systems
   B31.9-2008..............Building Services Piping
   B40.100-1998............Pressure Gauges and Gauge Attachments
C. American Society of Heating, Refrigerating and Air-Conditioning Engineers
   ASHRAE 135-2008........A Data Communication Protocol for Building Automation and Control Networks (ANSI)
D. American Society for Testing and Materials (ASTM)
   A53-2006...............Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   A106-2006...............Seamless Carbon Steel Pipe for High Temperature Service
E. Consumer Electronics Association (CEA)
   709.1B-2002............Control Network Protocol Specification
   709.3-1999.............Free-Topology Twisted-Pair Channel Specification
F. Federal Communications Commission (FCC)
EMC-2002................FCC Electromagnetic Compliance Requirements
G. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
81-1983................IEEE Guide for Measuring Earth Resistivity, 
Ground Impedance, and Earth Surface Potentials 
of a Ground System
100-2000.............The Authoritative Dictionary of IEEE Standards 
Terms
802.1D-2004............Media Access Control Bridges
802.2-2003..............Standards for Local Area Networks: Logical Link 
Control
802.3-2005..............Information Technology - Telecommunications and 
Information Exchange between Systems. Local and 
Metropolitan Area Networks - Specific 
Requirements - Part 3: Carrier Sense Multiple 
Access with Collision Detection (CSMA/CD) 
Access Method and Physical Layer Specifications 
(ANSI)
1100-2005.............Recommended Practice for Powering and Grounding 
Electronic Equipment (ANSI)
C37.90.1-2002............Surge Withstand Capability (SWC) Tests for 
Relays and Relay Systems Associated with 
Electric Power Apparatus
C57.13-2008..............Standard Requirements for Instrument 
Transformers
C62.41.1-2002............Guide on the Surges Environment in Low- 
Voltage (1000 V and Less) AC Power Circuits
C62.41.2-2002............Recommended Practice on Characterization of 
Surges in Low-Voltage (1000 V and Less) AC 
Power Circuits
H. International Electrotechnical Commission (IEC)
IEC 61000-2005............Electromagnetic Compatibility (EMC)- Part 4-5: 
Testing and Measurement Techniques; Surge 
Immunity Test
I. National Electrical Contractors Association
NECA 1-2006.............Good Workmanship in Electrical Construction
J. National Electrical Manufacturers Association (NEMA)
250-2008..............Enclosures for Electrical Equipment (1000 Volts 
Maximum)
C12.1-2008............Electric Meters; Code for Electricity Metering
C12.20-2002............Electricity Meter - 0.2 and 0.5 Accuracy Classes
C62.61-1993............Gas Tube Surge Arresters on Wire Line Telephone Circuits
ICS 1-2008.............Standard for Industrial Control and Systems General Requirements

K. National Institute of Standards and Technology (NIST)

L. National Fire Protection Association (NFPA)
30-08...................Flammable and Combustible Liquids Code
70-2008..................National Electrical Code (NEC)
54-06...................National Fuel Gas Code
85-07...................Boiler and Combustion Systems Hazard Code
101-06..................Life Safety Code
262-2007................Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

M. NSF International
14-03...................Plastics Piping Components and Related Materials
61-02...................Drinking Water System Components-Health Effects (Sections 1-9)

N. Telecommunications Industry Association, (TIA/EIA)
H-088C3...............Pathway Design Handbook
232-F-2002...............Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
PART 2 - PRODUCTS

2.4 GROUNDING

A. 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 VA 27 05 26 Grounding and Bonding for Communications Systems and with VA 26 05 26 Grounding and Bonding for Electrical Systems.

2.5 METER COMMUNICATION

A. Provide a BACNet network allowing communication from the meters’ data heads to the Site Data Aggregation Device.

B. Provide data heads at each meter, converting analog and pulsed information to digital information. Data heads shall allow for up to 24 hours of data storage (including time stamp, measured value, and scaling factor).

1. Each data head shall reside on a BACnet network using the MS/TP Data Link/Physical layer protocol. Each data head shall have a communication port for connection to an operator interface.

2. Environment: Data Head hardware shall be suitable for the conditions ranging from -29°C to 60°C (-20°F to 140°F). Data Heads used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at conditions ranging from -29°C to 60°C (-20°F to 140°F).

3. Provide a local keypad and display for interrogating and editing data. An optional system security password shall be available to prevent unauthorized use of the keypad and display.
4. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.

5. Memory. The building controller shall maintain all BIOS and data in the event of a power loss for at least 72 hours.

6. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

2.7 WATER, OIL, GAS METER DEVICES

A. Water and steam meter applications:

1. Steam Meters: provide vortex-shedding flowmeters, along with temperature sensors and pressure transducers to develop the energy flow.

2. Potable (Domestic) Water: provide a magnetic flowmeter in new installation.

B. Turbine flowmeters (water duty).

1. Flowmeter shall be as specified in Section 23 09 23, in the “water flow sensors” paragraph. Provide data head on meter as specified in this section.

2. Sensor shall be insertion turbine type with turbine element, retractor and preamplifier/transmitter mounted on a two-inch full port isolation valve; assembly easily removed or installed as a single unit under line pressure through the isolation valve without interference with process flow; calibrated scale shall allow precise positioning of the flow element to the required insertion depth within plus or minute 0.05 inch; wetted parts shall be constructed of stainless steel. Operating power shall be nominal 24 VDC. Local instantaneous flow indicator shall be LED type in NEMA 4 enclosure with 3-1/2 digit display, for wall or panel mounting.
   a. Ambient conditions: -40 to 60 degrees C (-40 to 140 degrees F), 5 to 100 percent humidity
   b. Operating conditions: 850 kPa (125 psig), 0 to 120 degrees C (30 to 250 degrees F), 0.15 to 12 m per second (0.5 to 40 feet per second) velocity.

3. Performance:
a. Transmitted signal from flowmeter and its transmitter shall have a total (rms) accuracy plus or minus 1% of actual flow rate.

b. Flowmeter accuracy shall be no more than plus or minus 0.1% of actual flow rate. Flowmeter repeatability shall be no more than 0.3% of actual flow rate. Meter shall be designed to minimize vibration effect and to provide elimination of this effect.

c. Minimum turndown capability shall be 20:1.

d. Pressure drop shall be as scheduled, maximum 1% of line pressure in lines sized 4 inches and larger.

e. Ambient temperature effects, less than 0.005 percent calibrated span per degree C (degree F) temperature change.

f. RFI effect - flow meter shall not be affected by RFI.

g. Power supply effect less than 0.02 percent of actual flow rate for a variation of plus or minus 10 percent power supply.

4. Provide a data head on the meter.

a. Preamplifier mounted on meter shall provide 4-20 ma divided pulse output or switch closure signal for units of volume or mass per a time base. Signal transmission distance shall be a minimum of 1,800 meters (6,000 feet).

5. Straightening Vanes: Provide as recommended by the meter manufacturer for the actual installation arrangement.

C. Magnetic flowmeters.

1. Meter shall have an all-welded flanged 316 stainless steel engineered flow tube with no seals. No sensor parts shall be exposed to the flow stream. Design meter for mating with Schedule 40 piping.

a. Meter shall be suitable for 25% warmer than the fluid operating temperature and for 25% higher than either the fluid’s operating pressure or 25% higher than the piping system’s safety valve set pressure, whichever is higher.

b. Meter flanges shall be Class 150 or higher, if required by the piping system’s temperature and pressure Class.

c. Meter shall be suitable for installation in ambient conditions ranging from -29 to 60 degrees C (-20 to 140 degrees F).

2. Provide meter data head.

a. Meters shall have digital readout of pressure-compensated flow rate and totalization located at transmitter and transmit flow rate and totalization digital signals to the Site Data.
Aggregation Device // and recorders //. As an option, pressure compensation and the compensated flow rate may be performed and displayed by the Site Data Aggregation Device receiving signals from the flow meter and from a pressure transmitter.

b. Provide programmable microprocessor electronics with on-board programming. Output signals shall be immune to ambient temperature swings. Processor shall include continuous self-diagnostic routines that identify electronics problems and provide a warning. Electronics shall be replaceable in the field without affecting metering accuracy. Provide power supply as recommended by meter manufacturer. Mount electronics in a NEMA 4 enclosure separate from meter body in position accessible from platform or floor without the use of a portable ladder.

1) Power supply to meter and transmitter shall be 120V/60hz.

Provide a Class 2 control voltage transformer for 24VDC power to meter as needed.

3. Performance:

a. Transmitted signal from flowmeter and its transmitter shall have a total (rms) accuracy plus or minus 1.5% of flow rate.

b. Flowmeter accuracy shall be no more than plus or minus 1.5% of actual flow rate for gasses and plus or minus 1% of actual flow rate for liquids. Flowmeter repeatability shall be no more than 0.2% of actual flow rate. Meter shall be designed to minimize vibration effect and to provide elimination of this effect.

c. Minimum turndown ratio shall be 20:1 for gasses and liquids. Maximum fluid pressure drop shall be as scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Cabling

1. Install Category 5e UTP, Category 6 UTP, and optical fiber cabling system as detailed in TIA-568-C.1, TIA/EIA-568-B.2, or TIA-568-C.3.

2. Screw terminals shall not be used except where specifically indicated on plans.

3. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations.

4. Do not untwist Category 5e, Category 6 UTP cables more than 12 mm (1/2 inch) from the point of termination to maintain cable geometry.
5. Provide service loop on each end of the cable, 3 m (10 feet) at the server rack and 304 mm (12 inches) at the meter.
6. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables.
7. Provide a device to monitor cable pull tensions. Do not exceed 110 N (25 pounds) pull tension for four pair copper cables.
8. Do not chafe or damage outer jacket materials.
9. Use only lubricants approved by cable manufacturer.
10. Do not over cinch cables, or crush cables with staples.
11. For UTP cable, bend radii shall not be less than four times the cable diameter.
12. Cables shall be terminated; no cable shall contain unterminated elements.
13. Cables shall not be spliced.
14. Label cabling in accordance with paragraph Labeling in this section.

B. Labeling
1. Labels: Provide labeling in accordance with TIA/EIA-606-A. Handwritten labeling is unacceptable. Stenciled lettering for all circuits shall be provided using laser printer.
2. Cables: Cables shall be labeled using color labels on both ends with identifiers in accordance with TIA/EIA-606-A.

C. Grounding: ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and grounding conductor of nonmetallic sheathed cables, as well as equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Comply with VA 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS and with VA 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

D. Water and steam Meters
1. Thermowells
   a. Install thermowells with socket extending a minimum of 2 inches into fluid or one-third of pipe diameter and in vertical position in piping tees.
   b. Install thermowells of sizes required to match temperature sensor connectors. Include bushings if required to match sizes.
   c. Install thermowells with extension on insulated piping.
d. Fill thermowells with heat-transfer medium.

2. Provide a test plug beside each temperature sensor.

3. Flow meters, general
   a. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
   b. Connect flowmeter-system elements to meters, connect flowmeter transmitters to meters, and connect thermal-energy meter transmitters to meters.
   c. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.
   d. Install flowmeter elements in accessible positions in piping systems.
   e. Install flowmeter, with minimum 20 x pipe diameter straight lengths of pipe upstream and minimum 10 x pipe diameter straight lengths of pipe downstream from flowmeter unless otherwise indicated by manufacturer's written instructions.
   f. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.

3.2 ADJUSTING AND 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.

3.3 FIELD QUALITY CONTROL
   A. The power monitoring and control system vendor must be able to provide development, integration and installation services required to complete and turn over a fully functional system including:
      1. Project management to coordinate personnel, information and on-site supervision for the various levels and functions of suppliers required for completion of the project.
      2. All technical coordination, installation, integration, and testing of all components.
      3. Detailed system design and system drawings.
   B. Cabling, equipment and hardware manufacturers shall have a minimum of 5 years experience in the manufacturing, assembly, and factory testing of
components which comply with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2 and EIA TIA/EIA-568-B.3.

C. The network cabling contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified network cabling systems and equipment. The contractor shall demonstrate experience in providing successful systems within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful network cabling system installations.

1. Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel.

3.4 ACCEPTANCE TESTING

A. Develop testing procedures to address all specified functions and components of the Advanced Utility Metering System (AUMS). Testing shall demonstrate proper and anticipated responses to normal and abnormal operating conditions.

1. Provide skilled technicians to start and operate equipment.
2. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
3. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for issues identified in testing.
4. Provide all tools to start, check-out and functionally test equipment and systems.
5. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for issues identified in any testing.
6. Review test procedures, testing and results with Government.

B. Testing checklists: Develop project-specific checklists to document the systems and all components are installed in accordance with the manufacturers recommendation and the Contract Documents.

C. Before testing, the following prerequisite items must be completed.

1. All related equipment has been started and start-up reports and checklists submitted and approved as ready for testing:
2. All associated system functions for all interlocking systems are programmed and operable per contract documents.
3. All punchlist items for the AUMS and equipment are corrected.
4. The test procedures reviewed and approved.
5. Safeties and operating ranges reviewed.

D. The following testing shall be included:
1. Demonstrate reporting of data and alarm conditions for each point and ensure that alarms are received at the assigned location, including Site Data Collection Device.
2. Demonstrate ability of software program to function for the intended application.
3. Demonstrate via graphed trends to show the reports are executed in correct manner.
4. Demonstrate that the meter readings are accurate using portable NIST traceable portable devices and calibrated valves in the piping system
5. Demonstrate that the systems perform during power loss and resumption of power.

E. Copper cables: Contractor shall provide all necessary testing equipment to test all copper network circuit cables. Tests shall conform to EIA/TIA 568B Permanent Link testing criteria. All testers are to be EIA/TIA 568B, Level IIe compliant. The primary field test parameters are:
1. Wire map: The wire map test is intended to verify pair to pin termination at each end and check for installation connectivity errors. For each of the conductors in the cable, the wire map indicates:
   a. Continuity to the remote end
   b. Shorts between any two or more conductors
   c. Crossed pairs
   d. Reversed pairs
   e. Split pairs
   f. Any other mis-wiring
2. Length requirements: The maximum physical length of the basic link shall be 94 meters (including test equipment cords).
3. Insertion Loss: Worst case insertion loss relative to the maximum insertion loss allowed shall be reported.
4. Near-end crosstalk (NEXT) loss: Field tests of NEXT shall be performed at both ends of the test configuration.
5. Power sum near-end crosstalk (PSNEXT) loss
6. Equal-level far-end crosstalk (ELFEXT): Field tests of ELFEXT shall be performed at both ends of the test configuration.

7. Power sum equal-level far-end crosstalk (PSELFEXT): Must be determined from both ends of the cable. Power sum Near End Crosstalk is not a category 3 parameter. For all frequencies from 1 to 100 MHz, the category 5e PSELFEXT of the cabling shall be measured in accordance with annex E of ANSI/TIA/EIA-568-B.2 and shall meet the values determined using equations (12) and (13) for the permanent link. PSELFEXT is not a required category 3 measurement parameter.

8. Return loss: Includes all the components of the link. The limits are based on the category of components and cable lengths. Return loss must be tested at both ends of the cable. Cabling return loss is not a required measurement for category 3 cabling.

9. Propagation delay and delay skew: Propagation delay is the time it takes for a signal to propagate from one end to the other. Propagation delay shall be measured in accordance with annex D of ANSI/TIA/EIA-568 B.2. The maximum propagation delay for all category permanent link configurations shall not exceed 498 ns measured at 10 MHz. Delay skew is a measurement of the signaling delay difference from the fastest pair to the slowest. Delay skew shall be measured in accordance with annex D of ANSI/TIA/EIA-568-B.2. The maximum delay skew for all category permanent link configurations shall not exceed 44 ns.

10. Administration: In addition to Pass/Fail indications, measured values of test parameters should be recorded in the administration system. Any reconfiguration of link components after testing may change the performance of the link and thus invalidates previous test results. Such links shall require retesting to regain conformance.

11. Test equipment connectors and cords: Adapter cords that are qualified and determined by the test equipment manufacturer to be suitable for permanent link measurements shall be used to attach the field tester to the permanent link under consideration.

12. Test setup: The permanent link test configuration is to be used by installers and users of data telecommunications systems to verify the performance of permanently installed cabling. A schematic representation of the permanent link is illustrated in figure 1. The permanent link consists of up to 90 m (295 ft) of horizontal cabling...
and one connection at each end and may also include an optional transition/consolidation point connection. The permanent link excludes both the cable portion of the field test instrument cord and the connection to the field test instrument.

13. Replace or repair and cables, connectors, and/or terminations found to be defective.

14. Repair, replace, and/or re-work any or all defective components to achieve cabling tests which meet or exceed 568B permanent link requirements prior to acceptance of the installation or payment for services.

2. OTDR Testing:
   a. OTDR testing is required on all backbone fiber optic cables
   b. The test shall be performed as per the EIA/TIA 455-61.
   c. Multimode testing shall be performed with a minimum 80 meter launch cable.
   d. Singlemode testing shall be performed with a minimum of 500 meter launch cable.
   e. Tests shall be performed on each fiber in each direction at both operating wavelengths.

3. Test report data shall reference cables by cable labeling standards. Tests shall be submitted on a 1.5mb, 3.5" DOS formatted floppy disk. Contractor shall provide tests in the native file format of the tester. Contractor shall provide all software needed to view, print, and edit tests.

4. Replace or repair and defective cables, connectors, terminations, etc.

5. Mated connector pairs shall have no more than 0.5dB loss. Fusion splices shall have no more than .15dB loss per splice. Cable attenuation shall be no more than 2% more than the attenuation of the cable on the reel as certified at the factory. Repair, replace, and/or rework any or all defective components to achieve specified test results prior to acceptance of the installation or payment for services.

G. Wireless Modems: Test system by sending 100,000 commands. Frame error rate shall not be greater than 5 out 100,000 commands.

3.5 DEMONSTRATION AND INSTRUCTION

A. Furnish the services of a factory-trained engineer or technician for a total of two four-hour classes to instruct designated Facility
Information Technologies personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the wired network system and connectivity equipment.

B. Before the System can be accepted by the VA, this training must be provided and executed. Training will be scheduled at the convenience of the Facilities Contracting Officer and Chief of Engineering Service.

C. On-site start-up and training of the advanced utility metering system shall include a complete working demonstration of the system with simulation of possible operating conditions that may be encountered.

1. Include any documentation and hands-on exercises necessary to enable electrical and mechanical operations personnel to assume full operating responsibility for the advanced utility monitoring system after completion of the training period.

D. Include 6 days on-site start-up assistance and 3 days on-site training in two sessions separated by minimum 1 month.

E. Regularly schedule and make available factory training for VA staff training on all aspects of advanced utility metering system including:

1. Comprehensive software and hardware setup, configuration, and operation.

2. Advanced monitoring and data reporting.

3. Advanced power quality and disturbance monitoring.

F. Before the system is accepted by the VA, the contractor shall walk-through the installation with the VA's representative and the design engineer to verify proper installation. The contractor may be requested to open enclosures and terminal compartments to verify cable labeling and/or installation compliance.

G. As-built drawings shall be provided noting the exact cable path and cable labeling information. Drawings in .DWG format will be available to the contractor. As-builts shall be submitted to the VA on disk saved as .DXF or .DWG files. Redline hardcopies shall be provided as well. CAD generated as-built information shall be shown on a new layer named AS_BUILT.

----- END -----

ADVANCED UTILITY METERING SYSTEM 25 10 10 - 25
HOT WATER TANK REPLACEMENT
FOR BUILDINGS 1 AND 2

DEPARTMENT OF VETERAN AFFAIRS
MANN-GRANDSTAFF VA MEDICAL CENTER
SPOKANE, WA

VA PROJECT NO. 668-16-101

November 30, 2016

100% SUBMITTAL

ELECTRICAL SPECIFICATIONS

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The Engineer’s seal and signature affixed hereon is all inclusive for the full content for this portion of the document.
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. 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 eight 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.

1.7 VARIATIONS FROM CONTRACT REQUIREMENTS
A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.
1.8 MATERIALS AND EQUIPMENT PROTECTION

A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.

1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.

2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.

3. Damaged equipment shall be repaired or replaced, as determined by the Resident Engineer.

4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

A. All electrical work shall comply with requirements of the latest NFPA 70 (NEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. However, energized electrical work may be performed only for the non-destructive and non-invasive diagnostic testing(s), or when scheduled outage poses an imminent hazard to patient care, safety, or physical security. In such case, all aspects of energized electrical work, such as the availability of appropriate/correct personal protective equipment (PPE) and the use of PPE, shall comply with the latest NFPA 70E, as well as the following requirements:

1. Only Qualified Person(s) shall perform energized electrical work. Supervisor of Qualified Person(s) shall witness the work of its
entirety to ensure compliance with safety requirements and approved work plan.

2. At least two weeks before initiating any energized electrical work, the Contractor and the Qualified Person(s) who is designated to perform the work shall visually inspect, verify and confirm that the work area and electrical equipment can safely accommodate the work involved.

3. At least two weeks before initiating any energized electrical work, the Contractor shall develop and submit a job specific work plan, and energized electrical work request to the Resident Engineer, 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 Resident Engineer, 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 Resident Engineer, and Medical Center’s Chief Engineer or his/her designee to witness the work.

D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

F. Coordinate location of equipment and conduit with other trades to minimize interference.
1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS
A. Equipment location shall be as close as practical to locations shown on the drawings.
B. Working clearances shall not be less than specified in the NEC.
C. Inaccessible Equipment:
   1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
   2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

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 Resident Engineer 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. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.
F. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

G. After approval and prior to installation, furnish the Resident Engineer with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.
4. Duct sealing compound.
5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER
A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.14 ACCEPTANCE CHECKS AND TESTS
A. The Contractor shall furnish the instruments, materials, and labor for tests.
B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer’s representatives and technicians so that a complete, functional, and operational system is delivered to the Government.
C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests for the equipment. Repair, replacement, and re-testing shall be accomplished at no additional cost to the Government.

1.15 WARRANTY
A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.
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. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS
A. Conductors and cables shall be thoroughly tested at the factory per NEMA to ensure that there are no electrical defects. Factory tests shall be certified.

1.5 SUBMITTALS
A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

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.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.

B. American Society of Testing Material (ASTM):
   D2301-10.................. Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
   D2304-10.................. Test Method for Thermal Endurance of Rigid Electrical Insulating Materials
   D3005-10.................. Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Electrical Manufacturers Association (NEMA):
   WC 70-09.................. Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

D. National Fire Protection Association (NFPA):
   70-11..................... National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):
   44-10..................... Thermoset-Insulated Wires and Cables
   83-08..................... Thermoplastic-Insulated Wires and Cables
   467-07..................... Grounding and Bonding Equipment
   486A-486B-03............. Wire Connectors
   486C-04..................... Splicing Wire Connectors
   486D-05..................... Sealed Wire Connector Systems
   486E-09..................... Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
   493-07..................... Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables
   514B-04..................... Conduit, Tubing, and Cable Fittings

SPEC WRITER NOTE: Delete between // ---- // if not applicable to project. Also delete any other item or paragraph not applicable to the section and renumber the paragraphs.
PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with NEMA, UL, as specified herein, and as shown on the drawings.

B. All conductors shall be copper.

C. Single Conductor and Cable:
   1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
   2. No. 8 AWG and larger: Stranded.
   3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
   4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

D. Color Code:
   1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
   2. No. 8 AWG and larger: Color-coded using one of the following methods:
      a. Solid color insulation or solid color coating.
      b. Stripes, bands, or hash marks of color specified.
      c. Color using 19 mm (0.75 inches) wide tape.
   4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
   5. Conductors shall be color-coded as follows:

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<th>480/277 V</th>
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<tbody>
<tr>
<td>Black</td>
<td>A</td>
<td>Brown</td>
</tr>
<tr>
<td>Red</td>
<td>B</td>
<td>Orange</td>
</tr>
<tr>
<td>Blue</td>
<td>C</td>
<td>Yellow</td>
</tr>
<tr>
<td>White</td>
<td>Neutral</td>
<td>Gray *</td>
</tr>
</tbody>
</table>

* or white with colored (other than green) tracer.

2.2 SPLICES

A. Splices shall be in accordance with NEC and UL.

B. Above Ground Splices for No. 10 AWG and Smaller:
   1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped conductors.
3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.
4. All bolts, nuts, and washers used with splices shall be zinc-plated/cadmium-plated steel.

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.
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. Install conductors in accordance with the NEC, as specified, and as shown on the drawings.
B. Install all conductors in raceway systems.
C. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.
D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.
E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.
G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.
I. Conductor and Cable Pulling:
   1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
   2. Use nonmetallic pull ropes.
   3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
   4. All conductors in a single conduit shall be pulled simultaneously.
   5. Do not exceed manufacturer’s recommended maximum pulling tensions and sidewall pressure values.
J. No more than three branch circuits shall be installed in any one conduit.
K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.2 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, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

3.4 EXISTING CONDUCTORS
A. Unless specifically indicated on the plans, existing conductors shall not be reused.

3.5 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.

3.6 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.

3.7 ACCEPTANCE CHECKS AND TESTS
A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
2. Electrical tests:
   a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.

c. Perform phase rotation test on all three-phase circuits.

---END---
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. 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. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS
A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.

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):
   B1-07.................Standard Specification for Hard-Drawn Copper Wire
   B3-07...............Standard Specification for Soft or Annealed Copper Wire
PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.

B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.

C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

D. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

2.4 GROUND CONNECTIONS

A. Above Grade:

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-plated steel bolts,
nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. Install grounding equipment in accordance with the NEC, as shown on the drawings, and as specified herein.

B. Equipment Grounding: Electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.3 RACEWAY

A. Conduit Systems:
   1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
   1. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:
   1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
   2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

D. Wireway Systems:
   1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

3.4 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.

3.5 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.

3.6 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.

---END---
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 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Conduits bracing.

C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

E. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground conduits.

F. Section 31 20 00, EARTHWORK: Bedding of conduits.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:
   a. 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.

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 National Standards Institute (ANSI):
   C80.1-05................Electrical Rigid Steel Conduit
   C80.3-05................Steel Electrical Metal Tubing
   C80.6-05................Electrical Intermediate Metal Conduit

C. National Fire Protection Association (NFPA):
   70-11....................National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):
   1-05......................Flexible Metal Conduit
   5-11......................Surface Metal Raceway and Fittings
   6-07......................Electrical Rigid Metal Conduit - Steel
   50-95.....................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-07..................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

E. National Electrical Manufacturers Association (NEMA):
TC-2-13................Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
TC-3-13................PVC Fittings for Use with Rigid PVC Conduit and Tubing
FB1-12..................Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
FB2.10-13...............Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate Metallic Conduit, and Electrical Metallic Tubing)
FB2.20-12...............Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable

F. American Iron and Steel Institute (AISI):
S100-2007..............North American Specification for the Design of Cold-Formed Steel Structural Members

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 13 mm (0.5-inch) unless otherwise shown. Where permitted by the NEC, 13 mm (0.5-inch) flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:
   1. Size: In accordance with the NEC, but not less than 13 mm (0.5-inch).

   2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and ANSI C80.1.


   4. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 V or less.

   5. Flexible Metal Conduit: Shall conform to UL 1.


C. Conduit Fittings:
1. Rigid Steel and Intermediate Metallic Conduit Fittings:
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
   d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   e. Erickson (Union-Type) and Set Screw Type Couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
   f. Sealing Fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2. Electrical Metallic Tubing Fittings:
   a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Compression Couplings and Connectors: Concrete-tight and rain-tight, with connectors having insulated throats.
   d.Indent-type connectors or couplings are prohibited.
   d. 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.

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. 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.

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 Resident Engineer 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 Resident Engineer 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.
3.2 INSTALLATION, GENERAL

A. In accordance with UL, NEC, NEMA, as shown on drawings, and as specified herein.

B. Raceway systems used for Essential Electrical Systems (EES) shall be entirely independent of other raceway systems.

C. Install conduit as follows:
   1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
   2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
   3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.
   4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
   5. Cut conduits square, ream, remove burrs, and draw up tight.
   6. Independently support conduit at 2.4 M (8 feet) on centers with specified materials and as shown on drawings.
   7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
   8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
   9. Close ends of empty conduits with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
10. Conduit installations under fume and vent hoods are prohibited.
11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
12. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
13. Conduit bodies shall only be used for changes in direction, and shall not contain splices.

D. Conduit Bends:
   1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown on drawings.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted and approved by the Resident Engineer/ COR/.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:
1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only:
   a. Where shown on the structural drawings.
   b. As approved by the Resident Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. 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, IMC, or EMT. Mixing different types of conduits in the same system is prohibited.
2. Align and run conduit parallel or perpendicular to the building lines.

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, IMC, or EMT. Mixing different types of conduits in the same 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. Painting:
   1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
   2. Paint all conduits containing cables rated over 600 V safety orange. 
      Refer to Section 09 91 00, PAINTING for preparation, paint type, and 
      exact color. In addition, paint legends, using 50 mm (2 inch) high 
      black numerals and letters, showing the cable voltage rating. 
      Provide legends where conduits pass through walls and floors and at 
      maximum 6 M (20 feet) intervals in between.

3.5 WET OR DAMP LOCATIONS
A. Use rigid steel or IMC conduits unless as shown on drawings.
B. Provide sealing fittings to prevent passage of water vapor where 
   conduits pass from warm to cold locations, i.e., refrigerated spaces, 
   constant-temperature rooms, air-conditioned spaces, building exterior 
   walls, roofs, or similar spaces.
C. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior 
   and below concrete building slabs in contact with soil, gravel, or 
   vapor barriers, unless as shown on drawings. Conduit shall be half- 
   lapped with 10 mil PVC tape before installation. After installation, 
   completely recoat or retape any damaged areas of coating.
D. Conduits run on roof shall be supported with integral galvanized lipped 
   steel channel, attached to UV-inhibited polycarbonate or polypropylene 
   blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded 
   rods, square washer and locknut. Conduits shall be attached to steel 
   channel with conduit clamps.

3.6 MOTORS AND VIBRATING EQUIPMENT
A. Use flexible metal conduit for connections to motors and other 
   electrical equipment subject to movement, vibration, misalignment, 
   cramped quarters, or noise transmission.
B. Use liquid-tight flexible metal conduit for installation in exterior 
   locations, moisture or humidity laden atmosphere, corrosive atmosphere, 
   water or spray wash-down operations, inside airstream of HVAC units, 
   and locations subject to seepage or dripping of oil, grease, or water.
C. Provide a green equipment grounding conductor with flexible and liquid- 
   tight flexible metal conduit.

3.7 CONDUIT SUPPORTS
A. Safe working load shall not exceed one-quarter of proof test load of 
   fastening devices.
B. Use pipe straps or individual conduit hangers for supporting individual conduits.
C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and an additional 90 kg (200 lbs). Attach each conduit with U-bolts or other approved fasteners.
D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
E. Hollow Masonry: Toggle bolts.
F. Bolts supported only by plaster or gypsum wallboard are not acceptable.
G. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
H. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
I. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
J. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.
K. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.8 BOX INSTALLATION
A. Boxes for Concealed Conduits:
   1. Flush-mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.
C. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.
D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.

F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.

H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."

I. On all branch circuit junction box covers, identify the circuits with black marker.