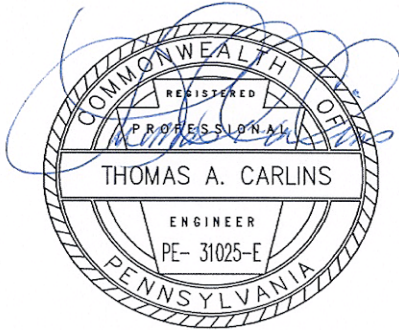




## **Bid Documents Submission**

Wilkes-Barre VAMC: A/E Upgrade Elevators 7 and 8  
VA244-13-C-0109



## **Technical Specifications**

### **Volume 1 of 1**

General Requirements  
Architectural  
Fire Suppression/Plumbing  
HVAC  
Electrical  
Communications  
Electronic Safety and Security

Wilkes-Barre VA Medical Center  
1111 East End Boulevard  
Wilkes-Barre, PA 18711

October 3, 2013



**DEPARTMENT OF VETERANS AFFAIRS  
 VHA MASTER SPECIFICATIONS**

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**SECTION 00 01 15**  
**LIST OF DRAWING SHEETS**

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

<u>Drawing No.</u>	<u>Title</u>
<b>GENERAL</b>	
G001	COVER SHEET
<b>ARCHITECTURAL</b>	
AD101	BASEMENT THROUGH TWELFTH FLOOR - DEMOLITION
A101	BASEMENT THROUGH TWELFTH FLOOR - NEW WORK/FINISHES
A201	ELEVATIONS
A202	ELEVATIONS
A203	ELEVATIONS
A204	ELEVATIONS
A205	ELEVATIONS
A206	ELEVATIONS
<b>FIRE PROTECTION</b>	
F001	SYMBOLS, ABBREVIATIONS, NOTES AND DETAILS
FD101	PARTIAL DEMOLITION PLANS - FIRE PROTECTION
F101	PARTIAL NEW WORK PLANS - FIRE PROTECTION
<b>PLUMBING</b>	
P101	PARTIAL NEW WORK PLAN - PLUMBING
<b>HVAC</b>	
H001	HVAC - SYMBOLS, LEGEND & GENERAL NOTES
HD101	HVAC DEMOLITION PLANS
H101	HVAC NEW PLANS
H701	HVAC EQUIPMENT SCHEDULES

VA Project No. 693-12-106  
AE Works Project No. 13003

Wilkes-Barre VAMC  
Upgrade Elevators 7 and 8

**ELECTRICAL**

E001	ELECTRICAL SYMBOLS, NOTES AND SCHEDULES
ED101	DEMOLITION PLANS - ELECTRICAL
E101	NEW WORK PLANS - ELECTRICAL

- - - END - - -



**SECTION 01 00 00**  
**GENERAL REQUIREMENTS**

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**SECTION 01 00 00**  
**GENERAL REQUIREMENTS**

**1.1 GENERAL INTENTION**

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for Upgrade Elevators 7 and 8, Wilkes-Barre Veterans Affairs Medical Center, 1111 East End Boulevard, Wilkes-Barre, PA 18711, as required by the drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.
- C. Offices of AE Works Ltd., 6587 Hamilton Avenue, Pittsburgh, PA 15206, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.
- D. Contractor shall be responsible for the operation, maintenance and repair of both elevators (S-7 & S-8) once the Contractor takes custody of the elevator mechanical room; or begins work on any of the elevator cabs, landing doors or controls. The government will take responsibility for any required maintenance after commissioning and testing has been completed. The government will take responsibility for repairs after the warrantee period has expired.
- D. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the Resident Engineer in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the Resident Engineer.

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- E. All employees of General Contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- F. Prior to commencing work, General Contractor shall provide proof that an OSHA designated "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- G. Training:
  - 1. All employees of General Contractor or subcontractors shall have the 10-hour or 30-hour OSHA Construction Safety course and other relevant competency training, as determined by RE/COR acting as the Construction Safety Officer, with input from the facility Construction Safety Committee.
  - 2. Submit training records of all such employees for approval before the start of work.
- H. VHA Directive 2011-36, Safety and Health during Construction, dated 9/22/2011 in its entirety is made a part of this section

#### **1.2 STATEMENT OF BID ITEM(S)**

- A. ITEM I, GENERAL CONSTRUCTION: Work includes general construction, alterations, mechanical and electrical work, elevators, and all necessary removal and disposal of existing structures and construction and certain other items.

#### **1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR**

- A. AFTER AWARD OF CONTRACT, fifteen (15) sets of specifications and drawings will be furnished. These drawings and specifications will in part, consist of those returned by prospective bidders.
- B. Additional sets of drawings may be made by the Contractor, at Contractor's expense, from reproducible sepia prints furnished by Issuing Office. Such sepia prints shall be returned to the Issuing Office immediately after printing is completed.

#### **1.4 CONSTRUCTION SECURITY REQUIREMENTS**

**A. Security Plan:**

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

**B. Security Procedures:**

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 3 days' notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the Contracting Officer.
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. Guards:**

1. The General Contractor shall provide unarmed guards at the project site after construction hours.
2. The guard shall have communication devices to report events as directed by VA police.
3. The General Contractor shall install equipment for recording guard rounds to ensure systematic checking of the premises.

D. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the Resident Engineer for the purpose of security inspections of every area of project, including tool boxes and parked machines, and take any emergency action.
2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

E. Document Control:

1. Before starting any work, the General Contractor/subcontractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manuals and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media (such as CDs and diskettes) shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".

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7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
  - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
  - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

**F. Motor Vehicle Restrictions**

1. Vehicle authorization request shall be required for any vehicle entering the site, and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. Separate permits shall be issued for General Contractor and its employees for parking in designated areas only.

**1.5 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.

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

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

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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 Resident Engineer and Facility 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 Resident Engineer 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.
- D. Separate temporary facilities (such as trailers, storage sheds, and dumpsters) from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Construction Partitions:
1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck



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- or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
2. Install fire-rated temporary construction partitions as shown on Drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
  3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- G. Means-of-Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Resident Engineer and Facility Safety Manager.
- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Resident Engineer and Facility Safety Manager.
- I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
- L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Resident Engineer and Facility Safety Manager. All

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existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Resident Engineer.

- M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Resident Engineer and Facility Safety Manager.
- N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Resident Engineer. Obtain permits from Facility Safety Manager at least twenty-four (24) hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Resident Engineer and Facility Safety Manager.
- P. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- R. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.
- S. If required, submit documentation to the Resident Engineer that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

#### **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. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer, and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor, and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

#### **(FAR 52.236-10)**

- D. Working space and space available for storing materials shall be as determined by the Resident Engineer.
- E. Workmen are subject to rules of Medical Center applicable to their conduct.

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F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by Resident Engineer where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.
2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.
3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.

G. Phasing: To ensure such executions, Contractor shall furnish the Resident Engineer with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the Resident Engineer two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to ensure accomplishment of this work in successive phases mutually agreeable to Medical Center Director, Resident Engineer and Contractor.

H. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Center's operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. Coordinate alteration work in areas occupied by Department of Veterans

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Affairs so that Medical Center operations will continue during the construction period.

- I. When a building, or portion thereof, is turned over to Contractor, Contractor shall accept entire responsibility therefore.
  1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.
  2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Company (Department of Veterans Affairs or municipal), whichever will be required to respond to an alarm from Contractor's employee or watchman.
- J. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by Resident Engineer.
  1. No utility service (such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems) may be interrupted without prior approval of the Resident Engineer. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Medical Center Director's prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.

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2. Contractor shall submit a request to interrupt any such services to Resident Engineer, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
  3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
  4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the Resident Engineer.
  5. In case of a contract construction emergency, service will be interrupted on approval of Resident Engineer. Such approval will be confirmed in writing as soon as practical.
  6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- K. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

- L. 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.
  2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the Resident Engineer.
- M. Coordinate the work for this contract with other construction operations as directed by Resident Engineer. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

#### **1.7 ALTERATIONS**

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

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B. Any items required by drawings to be either reused or relocated or both, found during this survey to be non-existent, or in the opinion of the Resident Engineer and/or Supply Representative, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).

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

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

D. Protection: Provide the following protective measures:

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



#### **1.8 INFECTION PREVENTION MEASURES**

- A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the Contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to Resident Engineer and Facility ICRA team for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  - 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- C. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:
  - 1. The RE and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.
  - 2. In case of any problem, the medical center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.

- D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold:
1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by Resident Engineer. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.
  2. Do not perform dust-producing tasks within occupied areas without the approval of the Resident Engineer. For construction in any areas that will remain jointly occupied by the Medical Center and Contractor's workers, the Contractor shall:
    - a. Provide dust-proof fire-rated temporary drywall construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Barriers shall be sealed and made presentable on hospital-occupied side. Install a self-closing rated door in a metal frame, commensurate with the partition, to allow worker access. Maintain negative air at all times. A fire-retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the Resident Engineer and Medical Center.
    - b. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not re-introduced to the Medical Center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Ensure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other pre-filter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy-duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the Medical Center.

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- c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24" x 36"), shall be used at all interior transitions from the construction area to occupied Medical Center areas. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
- d. Vacuum and wet mop all transition areas from construction to the occupied Medical Center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
- e. The Contractor shall not haul debris through patient-care areas without prior approval of the Resident Engineer and the Medical Center. When approved, debris shall be hauled in enclosed dust-proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
- f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.
- g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
- h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

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E. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

**1.9 DISPOSAL AND RETENTION**

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

1. Reserved items which are to remain property of the Government are identified by attached tags or noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by Resident Engineer.
2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

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4. PCB Transformers and Capacitors: The Contractor shall be responsible for disposal of the Polychlorinated Biphenyl (PCB) transformers and capacitors. The transformers and capacitors shall be taken out of service and handled in accordance with the procedures of the Environmental Protection Agency (EPA) and the Department of Transportation (DOT) as outlined in Code of Federal Regulation (CFR), Titled 40 and 49 respectively. The EPA's Toxic Substance Control Act (TSCA) Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7 also apply. Upon removal of PCB transformers and capacitors for disposal, the "originator" copy of the Uniform Hazardous Waste Manifest (EPA Form 8700-22), along with the Uniform Hazardous Waste Manifest Continuation Sheet (EPA Form 8700-22A) shall be returned to the Contracting Officer who will annotate the contract file and transmit the Manifest to the Medical Center's Chief.

a. Copies of the following listed CFR titles may be obtained from the Government Printing Office:

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

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

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

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

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

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

49 CFR 173.....Subpart A General

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

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

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

**1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND  
IMPROVEMENTS**

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

**(FAR 52.236-9)**

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

#### **1.11 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 Resident Engineer. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the Resident Engineer before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

#### **1.12 LAYOUT OF WORK**

- A. The Contractor shall lay out the work from Government-established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible

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for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

- B. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to Resident Engineer.
- C. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

#### **1.13 AS-BUILT DRAWINGS**

- A. The Contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To ensure compliance, as-built drawings shall be made available for the Resident Engineer's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the Resident Engineer within 15 calendar days after each completed phase and after the acceptance of the project by the Resident Engineer.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.



#### **1.14 USE OF ROADWAYS**

- A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the Resident Engineer, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.
- B. When new permanent roads are to be a part of this contract, Contractor may construct them immediately for use to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.
- C. When certain buildings (or parts of certain buildings) are required to be completed in advance of general date of completion, all roads leading thereto must be completed and available for use at time set for completion of such buildings or parts thereof.

#### **1.15 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT**

- A. Use of newly-installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted, subject to compliance with the following provisions:
  - 1. Permission to use each unit or system must be given by Resident Engineer. If the equipment is not installed and maintained in accordance with the following provisions, the Resident Engineer will withdraw permission for use of the equipment.
  - 2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.

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3. Units shall be properly lubricated, balanced, and aligned.  
Vibrations must be eliminated.
  4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
  5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
  6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

#### **1.16 TEMPORARY USE OF EXISTING ELEVATORS**

- A. Use of existing elevators for handling building materials and Contractor's personnel will be permitted subject to following provisions:
1. Contractor makes all arrangements with the Resident Engineer for use of elevators. The Resident Engineer will ascertain that elevators are in proper condition. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.

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2. Contractor covers and provides maximum protection of following elevator components:
  - a. Entrance jambs, heads soffits and threshold plates.
  - b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
  - c. Finish flooring.
3. Government will accept hoisting ropes of elevator and rope of each speed governor if they are worn under normal operation. However, if these ropes are damaged by action of foreign matter such as sand, lime, grit, stones, etc., during temporary use, they shall be removed and replaced by new hoisting ropes.
4. If brake lining of elevators are excessively worn or damaged during temporary use, they shall be removed and replaced by new brake lining.
5. All parts of main controller, starter, relay panel, selector, etc., worn or damaged during temporary use shall be removed and replaced with new parts, if recommended by elevator inspector after elevator is released by Contractor.
6. Place elevator in condition equal, less normal wear, to that existing at time it was placed in service of Contractor as approved by Contracting Officer.

#### **1.17 TEMPORARY USE OF NEW ELEVATORS**

- A. The Contractor and his personnel shall be permitted use of new elevator(s) subject to the following provisions:
  1. Contractor shall make arrangements with the Resident Engineer for use of elevator(s). Contractor may obtain elevator(s) for exclusive use.

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

**1.18 TEMPORARY TOILETS**

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

**1.19 AVAILABILITY AND USE OF UTILITY SERVICES**

- A. The Government shall make all reasonably-required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.
- C. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:
1. Obtain heat by connecting to Medical Center heating distribution system.
    - a. Steam is available at no cost to Contractor.

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D. Electricity (for Construction and Testing): Furnish all temporary electric services.

1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.

E. Water (for Construction and Testing): Furnish temporary water service.

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

F. Steam: Furnish steam system for testing required in various sections of specifications.

1. Obtain steam for testing by connecting to the Medical Center steam distribution system. Steam is available at no cost to the Contractor.
2. Maintain connections, pipe, fittings and fixtures and conserve steam-use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at Resident Engineer's discretion), of use of steam from the Medical Center's system.

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

#### **1.20 NEW TELEPHONE EQUIPMENT**

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

#### **1.21 TESTS**

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

## **1.22 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals (hard copies and electronic) and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals and one compact disc (four hard copies and one electronic copy each) for each separate piece of equipment shall be delivered to the Resident Engineer coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.
- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed 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 Resident Engineer and shall be considered concluded only when the Resident Engineer 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 Resident Engineer, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

#### **1.23 GOVERNMENT-FURNISHED PROPERTY**

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on the drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.
- C. Storage space for equipment will be provided by the Government, and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at the Medical Center.
- D. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.
  - 1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
  - 2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.
- E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to make the connection between the Government furnished equipment item and

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the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.

- F. Completely assemble and install the Government-furnished equipment in place ready for proper operation in accordance with specifications and drawings.
- G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

#### **1.24 RELOCATED EQUIPMENT AND ITEMS**

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the Resident Engineer.
- C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".
- D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.
- E. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately.

**1.25 HISTORIC PRESERVATION**

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

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

**PART 1- GENERAL**

**1.1 DESCRIPTION**

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

**1.2 CONTRACTOR'S REPRESENTATIVE**

- A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative (COR).
- B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section.
- C. The Contractor's representative shall have the option of developing the project schedule within their organization or to engage the services of an outside consultant. If an outside scheduling consultant is utilized, Section 1.3 of this specification will apply.

**1.3 CONTRACTOR'S CONSULTANT**

- A. The Contractor shall submit a qualification proposal to the COR, within 10 days of bid acceptance. The qualification proposal shall include:
1. The name and address of the proposed consultant.
  2. Information to show that the proposed consultant has the qualifications to meet the requirements specified in the preceding paragraph.
  3. A representative sample of prior construction projects, which the proposed consultant has performed complete project scheduling services. These representative samples shall be of similar size and scope.

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

#### **1.4 COMPUTER-PRODUCED SCHEDULES**

- A. The Contractor shall provide monthly, to the Department of Veterans Affairs (VA), all computer-produced time/cost schedules and reports generated from monthly project updates. This monthly computer service will include: three copies of up to five different reports (inclusive of all pages) available within the user defined reports of the scheduling software approved by the Contracting Officer; a hard copy listing of all project schedule changes, and associated data, made at the update and an electronic file of this data; and the resulting monthly updated schedule in PDM format. These must be submitted with and substantively support the contractor's monthly payment request and the signed look ahead report. The COR shall identify the five different report formats that the contractor shall provide.
- B. The Contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also responsible for the accurate and timely submittal of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.
- C. The VA will report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports and associated diskette(s), when requested by the Contracting Officer's representative, to correct errors which affect the payment and schedule for the project.

#### 1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL

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

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

#### **1.6 WORK ACTIVITY/EVENT COST DATA**

- A. The Contractor shall cost-load all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. Negative work activity/event cost data will not be acceptable, except on VA-issued contract changes.
- B. The Contractor shall cost-load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS).



- C. In accordance with FAR 52.236 - 1 (PERFORMANCE OF WORK BY THE CONTRACTOR) and VAAR 852.236 - 72 (PERFORMANCE OF WORK BY THE CONTRACTOR), the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work.
- D. The Contractor shall cost-load work activities/events for all BID ITEMS including ASBESTOS ABATEMENT. The sum of each BID ITEM work shall equal the value of the bid item in the Contractors' bid.

#### **1.7 PROJECT SCHEDULE REQUIREMENTS**

- A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor shall:
1. Show activities/events as:
    - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
    - b. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
    - c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
    - d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
    - e. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase.
  2. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.

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3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.
  4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
  5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.
- B. The Contractor shall submit the following supporting data in addition to the project schedule:
1. The appropriate project calendar including working days and holidays.
  2. The planned number of shifts per day.
  3. The number of hours per shift.
- Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.
- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COR. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the COR's approval of the Project Schedule.
- D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

#### **1.8 PAYMENT TO THE CONTRACTOR**

- A. Monthly, the contractor shall submit the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.
- B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

#### **1.9 PAYMENT AND PROGRESS REPORTING**

- A. Monthly schedule update meetings will be held on dates mutually agreed to by the COR and the Contractor. Contractor and their CPM consultant (if applicable) shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the COR three work days in advance of the schedule update meeting. Job progress will be reviewed to verify:
1. Actual start and/or finish dates for updated/completed activities/events.
  2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
  3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
  4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
  5. Completion percentage for all completed and partially completed activities/events.
  6. Logic and duration revisions required by this section of the specifications.

7. Activity/event duration and percent complete shall be updated independently.
- B. After completion of the joint review, the contractor shall generate an updated computer-produced calendar-dated schedule and supply the Contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.
- C. After completing the monthly schedule update, the contractor's representative or scheduling consultant shall rerun all current period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and resident engineer for the contract change(s). When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the resident engineer. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the resident engineer within fourteen (14) calendar days of completing the regular schedule update. **Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.**
- D. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work

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and administrative actions necessary to maintain project schedule status during the reporting period. This schedule coordination meeting will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

#### **1.10 RESPONSIBILITY FOR COMPLETION**

- A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
  - 1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
  - 2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
  - 3. Reschedule the work in conformance with the specification requirements.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the COR for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Government.

#### **1.11 CHANGES TO THE SCHEDULE**

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

3. The schedule does not represent the actual prosecution and progress of the project.
  4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.
- B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.
- C. Contracting Officer's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.
- D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.
- E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

#### **1.12 ADJUSTMENT OF CONTRACT COMPLETION**

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.

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- B. Actual delays in activities/events which, according to the computer-produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.
- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-work activities/events such as RFIs, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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**SECTION 01 33 23**  
**SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**

- 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 (including laboratory samples to be tested), 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 (including any laboratory samples to be tested), 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. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. 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.
- 1-8. 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.
- 1-9. 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 required by Section 09 06 00, SCHEDULE FOR FINISHES, in quadruplicate. Submit other 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.
  - B. Submittals will receive consideration only when covered by a transmittal letter signed by the Contractor. Letter shall be sent via first class mail, and shall contain the list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications

for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.

1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
  2. 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.
  3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests (those preceded by symbol "LT" under the separate sections of the specification shall be tested, at the expense of the Contractor, in a commercial laboratory approved by Contracting Officer.
1. Laboratory shall furnish Contracting Officer with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
  2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past five years.
  3. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.
  4. Contractor shall send a copy of transmittal letter to both Resident Engineer and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
  5. Laboratory test reports shall be sent directly to Resident Engineer for appropriate action.

6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. 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.
- E. 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.
- F. 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.

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5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.
- 1-10. Samples (except laboratory samples), shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval directly to the COR.
- 1-11. At the time of transmittal to the COR, the Contractor shall also send a copy of the complete submittal to the Architect.

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**SECTION 01 42 19**  
**REFERENCE STANDARDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

**1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)**

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

**1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)**

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.

AA	Aluminum Association Inc. <a href="http://www.aluminum.org">http://www.aluminum.org</a>
AABC	Associated Air Balance Council <a href="http://www.aabchq.com">http://www.aabchq.com</a>
AAMA	American Architectural Manufacturer's Association <a href="http://www.aamanet.org">http://www.aamanet.org</a>
AAN	American Nursery and Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
AASHTO	American Association of State Highway and Transportation Officials <a href="http://www.aashto.org">http://www.aashto.org</a>
AATCC	American Association of Textile Chemists and Colorists <a href="http://www.aatcc.org">http://www.aatcc.org</a>
ACGIH	American Conference of Governmental Industrial Hygienists <a href="http://www.acgih.org">http://www.acgih.org</a>
ACI	American Concrete Institute <a href="http://www.aci-int.net">http://www.aci-int.net</a>
ACPA	American Concrete Pipe Association <a href="http://www.concrete-pipe.org">http://www.concrete-pipe.org</a>
ACPPA	American Concrete Pressure Pipe Association <a href="http://www.acppa.org">http://www.acppa.org</a>
ADC	Air Diffusion Council <a href="http://flexibleduct.org">http://flexibleduct.org</a>
AGA	American Gas Association <a href="http://www.aga.org">http://www.aga.org</a>



AGC	Associated General Contractors of America <a href="http://www.agc.org">http://www.agc.org</a>
AGMA	American Gear Manufacturers Association, Inc. <a href="http://www.agma.org">http://www.agma.org</a>
AHAM	Association of Home Appliance Manufacturers <a href="http://www.aham.org">http://www.aham.org</a>
AISC	American Institute of Steel Construction <a href="http://www.aisc.org">http://www.aisc.org</a>
AISI	American Iron and Steel Institute <a href="http://www.steel.org">http://www.steel.org</a>
AITC	American Institute of Timber Construction <a href="http://www.aitc-glulam.org">http://www.aitc-glulam.org</a>
AMCA	Air Movement and Control Association, Inc. <a href="http://www.amca.org">http://www.amca.org</a>
ANLA	American Nursery & Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
ANSI	American National Standards Institute, Inc. <a href="http://www.ansi.org">http://www.ansi.org</a>
APA	The Engineered Wood Association <a href="http://www.apawood.org">http://www.apawood.org</a>
ARI	Air-Conditioning and Refrigeration Institute <a href="http://www.ari.org">http://www.ari.org</a>
ASAE	American Society of Agricultural Engineers <a href="http://www.asae.org">http://www.asae.org</a>
ASCE	American Society of Civil Engineers <a href="http://www.asce.org">http://www.asce.org</a>
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers <a href="http://www.ashrae.org">http://www.ashrae.org</a>

ASME	American Society of Mechanical Engineers <a href="http://www.asme.org">http://www.asme.org</a>
ASSE	American Society of Sanitary Engineering <a href="http://www.asse-plumbing.org">http://www.asse-plumbing.org</a>
ASTM	American Society for Testing and Materials <a href="http://www.astm.org">http://www.astm.org</a>
AWI	Architectural Woodwork Institute <a href="http://www.awinet.org">http://www.awinet.org</a>
AWS	American Welding Society <a href="http://www.aws.org">http://www.aws.org</a>
AWWA	American Water Works Association <a href="http://www.awwa.org">http://www.awwa.org</a>
BHMA	Builders Hardware Manufacturers Association <a href="http://www.buildershardware.com">http://www.buildershardware.com</a>
BIA	Brick Institute of America <a href="http://www.bia.org">http://www.bia.org</a>
CAGI	Compressed Air and Gas Institute <a href="http://www.cagi.org">http://www.cagi.org</a>
CGA	Compressed Gas Association, Inc. <a href="http://www.cganet.com">http://www.cganet.com</a>
CI	The Chlorine Institute, Inc. <a href="http://www.chlorineinstitute.org">http://www.chlorineinstitute.org</a>
CISCA	Ceilings and Interior Systems Construction Association <a href="http://www.cisca.org">http://www.cisca.org</a>
CISPI	Cast Iron Soil Pipe Institute <a href="http://www.cispi.org">http://www.cispi.org</a>
CLFMI	Chain Link Fence Manufacturers Institute <a href="http://www.chainlinkinfo.org">http://www.chainlinkinfo.org</a>

CPMB	Concrete Plant Manufacturers Bureau <a href="http://www.cpmc.org">http://www.cpmc.org</a>
CRA	California Redwood Association <a href="http://www.calredwood.org">http://www.calredwood.org</a>
CRSI	Concrete Reinforcing Steel Institute <a href="http://www.crsi.org">http://www.crsi.org</a>
CTI	Cooling Technology Institute <a href="http://www.cti.org">http://www.cti.org</a>
DHI	Door and Hardware Institute <a href="http://www.dhi.org">http://www.dhi.org</a>
EGSA	Electrical Generating Systems Association <a href="http://www.egsa.org">http://www.egsa.org</a>
EEI	Edison Electric Institute <a href="http://www.eei.org">http://www.eei.org</a>
EPA	Environmental Protection Agency <a href="http://www.epa.gov">http://www.epa.gov</a>
ETL	ETL Testing Laboratories, Inc. <a href="http://www.etl.com">http://www.etl.com</a>
FAA	Federal Aviation Administration <a href="http://www.faa.gov">http://www.faa.gov</a>
FCC	Federal Communications Commission <a href="http://www.fcc.gov">http://www.fcc.gov</a>
FPS	The Forest Products Society <a href="http://www.forestprod.org">http://www.forestprod.org</a>
GANA	Glass Association of North America <a href="http://www.cssinfo.com/info/gana.html/">http://www.cssinfo.com/info/gana.html/</a>
FM	Factory Mutual Insurance <a href="http://www.fmglobal.com">http://www.fmglobal.com</a>

GA	Gypsum Association <a href="http://www.gypsum.org">http://www.gypsum.org</a>
GSA	General Services Administration <a href="http://www.gsa.gov">http://www.gsa.gov</a>
HI	Hydraulic Institute <a href="http://www.pumps.org">http://www.pumps.org</a>
HPVA	Hardwood Plywood & Veneer Association <a href="http://www.hpva.org">http://www.hpva.org</a>
ICBO	International Conference of Building Officials <a href="http://www.icbo.org">http://www.icbo.org</a>
ICEA	Insulated Cable Engineers Association Inc. <a href="http://www.icea.net">http://www.icea.net</a>
ICAC	Institute of Clean Air Companies <a href="http://www.icac.com">http://www.icac.com</a>
IEEE	Institute of Electrical and Electronics Engineers <a href="http://www.ieee.org">http://www.ieee.org</a>
IMSA	International Municipal Signal Association <a href="http://www.imsasafety.org">http://www.imsasafety.org</a>
IPCEA	Insulated Power Cable Engineers Association
NBMA	Metal Buildings Manufacturers Association <a href="http://www.mbma.com">http://www.mbma.com</a>
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. <a href="http://www.mss-hq.com">http://www.mss-hq.com</a>
NAAMM	National Association of Architectural Metal Manufacturers <a href="http://www.naamm.org">http://www.naamm.org</a>
NAPHCC	Plumbing-Heating-Cooling Contractors Association <a href="http://www.phccweb.org.org">http://www.phccweb.org.org</a>

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>

NHLA       National Hardwood Lumber Association  
            <http://www.natlhardwood.org>

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

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

NLMA       Northeastern Lumber Manufacturers Association, Inc.  
            <http://www.nelma.org>

NPA        National Particleboard Association  
            18928 Premiere Court  
            Gaithersburg, MD 20879  
            (301) 670-0604

NSF        National Sanitation Foundation  
            <http://www.nsf.org>

NWWDA    Window and Door Manufacturers Association  
            <http://www.nwwda.org>

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

PCA	Portland Cement Association <a href="http://www.portcement.org">http://www.portcement.org</a>
PCI	Precast Prestressed Concrete Institute <a href="http://www.pci.org">http://www.pci.org</a>
PPI	The Plastic Pipe Institute <a href="http://www.plasticpipe.org">http://www.plasticpipe.org</a>
PEI	Porcelain Enamel Institute, Inc. <a href="http://www.porcelainenamel.com">http://www.porcelainenamel.com</a>
PTI	Post-Tensioning Institute <a href="http://www.post-tensioning.org">http://www.post-tensioning.org</a>
RFCI	The Resilient Floor Covering Institute <a href="http://www.rfci.com">http://www.rfci.com</a>
RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. <a href="http://www.rma.org">http://www.rma.org</a>
SCMA	Southern Cypress Manufacturers Association <a href="http://www.cypressinfo.org">http://www.cypressinfo.org</a>
SDI	Steel Door Institute <a href="http://www.steeldoor.org">http://www.steeldoor.org</a>
IGMA	Insulating Glass Manufacturers Alliance <a href="http://www.igmaonline.org">http://www.igmaonline.org</a>
SJI	Steel Joist Institute <a href="http://www.steeljoist.org">http://www.steeljoist.org</a>
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. <a href="http://www.smacna.org">http://www.smacna.org</a>
SSPC	The Society for Protective Coatings <a href="http://www.sspc.org">http://www.sspc.org</a>

STI	Steel Tank Institute <a href="http://www.steeltank.com">http://www.steeltank.com</a>
SWI	Steel Window Institute <a href="http://www.steelwindows.com">http://www.steelwindows.com</a>
TCA	Tile Council of America, Inc. <a href="http://www.tileusa.com">http://www.tileusa.com</a>
TEMA	Tubular Exchange Manufacturers Association <a href="http://www.tema.org">http://www.tema.org</a>
TPI	Truss Plate Institute, Inc. 583 D'Onofrio Drive; Suite 200 Madison, WI 53719 (608) 833-5900
UBC	The Uniform Building Code See ICBO
UL	Underwriters' Laboratories Incorporated <a href="http://www.ul.com">http://www.ul.com</a>
ULC	Underwriters' Laboratories of Canada <a href="http://www.ulc.ca">http://www.ulc.ca</a>

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Wilkes-Barre VAMC  
Upgrade Elevators 7 and 8

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WCLIB      West Coast Lumber Inspection Bureau  
            6980 SW Varns Road, P.O. Box 23145  
            Portland, OR 97223  
            (503) 639-0651

WRCLA      Western Red Cedar Lumber Association  
            P.O. Box 120786  
            New Brighton, MN 55112  
            (612) 633-4334

WWPA      Western Wood Products Association  
            <http://www.wwpa.org>

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**SECTION 01 45 29**  
**TESTING LABORATORY SERVICES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by the Contractor.

**1.2 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- T27-11.....Standard Method of Test for Sieve Analysis of  
Fine and Coarse Aggregates
- T96-02 (R2006).....Standard Method of Test for Resistance to  
Degradation of Small-Size Coarse Aggregate by  
Abrasion and Impact in the Los Angeles Machine
- T99-10.....Standard Method of Test for Moisture-Density  
Relations of Soils Using a 2.5 Kg (5.5 lb.)  
Rammer and a 305 mm (12 in.) Drop
- T104-99 (R2007).....Standard Method of Test for Soundness of  
Aggregate by Use of Sodium Sulfate or Magnesium  
Sulfate
- T180-10.....Standard Method of Test for Moisture-Density  
Relations of Soils using a 4.54 kg (10 lb.)  
Rammer and a 457 mm (18 in.) Drop
- T191-02(R2006).....Standard Method of Test for Density of Soil In-  
Place by the Sand-Cone Method
- C. American Concrete Institute (ACI):
- 506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete

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

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

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

A416/A416M-10.....Standard Specification for Steel Strand,  
Uncoated Seven-Wire for Prestressed Concrete

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

C31/C31M-10.....Standard Practice for Making and Curing  
Concrete Test Specimens in the Field

C33/C33M-11a.....Standard Specification for Concrete Aggregates

C39/C39M-12.....Standard Test Method for Compressive Strength  
of Cylindrical Concrete Specimens

C109/C109M-11b.....Standard Test Method for Compressive Strength  
of Hydraulic Cement Mortars

C136-06.....Standard Test Method for Sieve Analysis of Fine  
and Coarse Aggregates

C138/C138M-10b.....Standard Test Method for Density (Unit Weight),  
Yield, and Air Content (Gravimetric) of  
Concrete

C140-12.....Standard Test Methods for Sampling and Testing  
Concrete Masonry Units and Related Units

C143/C143M-10a.....Standard Test Method for Slump of Hydraulic  
Cement Concrete

C172/C172M-10.....Standard Practice for Sampling Freshly Mixed  
Concrete

C173/C173M-10b.....Standard Test Method for Air Content of freshly  
Mixed Concrete by the Volumetric Method

C330/C330M-09.....Standard Specification for Lightweight  
Aggregates for Structural Concrete

C567/C567M-11.....Standard Test Method for Density Structural  
Lightweight Concrete

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C780-11.....Standard Test Method for Pre-construction and  
Construction Evaluation of Mortars for Plain  
and Reinforced Unit Masonry

C1019-11.....Standard Test Method for Sampling and Testing  
Grout

C1064/C1064M-11.....Standard Test Method for Temperature of Freshly  
Mixed Portland Cement Concrete

C1077-11c.....Standard Practice for Agencies Testing Concrete  
and Concrete Aggregates for Use in Construction  
and Criteria for Testing Agency Evaluation

C1314-11a.....Standard Test Method for Compressive Strength  
of Masonry Prisms

D422-63(2007).....Standard Test Method for Particle-Size Analysis  
of Soils

D698-07e1.....Standard Test Methods for Laboratory Compaction  
Characteristics of Soil Using Standard Effort

D1140-00(2006).....Standard Test Methods for Amount of Material in  
Soils Finer than No. 200 Sieve

D1143/D1143M-07e1.....Standard Test Methods for Deep Foundations  
Under Static Axial Compressive Load

D1188-07e1.....Standard Test Method for Bulk Specific Gravity  
and Density of Compacted Bituminous Mixtures  
Using Coated Samples

D1556-07.....Standard Test Method for Density and Unit  
Weight of Soil in Place by the Sand-Cone Method

D1557-09.....Standard Test Methods for Laboratory Compaction  
Characteristics of Soil Using Modified Effort  
(56,000ft lbf/ft<sup>3</sup> (2,700 KNm/m<sup>3</sup>))

D2166-06.....Standard Test Method for Unconfined Compressive  
Strength of Cohesive Soil

D2167-08).....Standard Test Method for Density and Unit  
Weight of Soil in Place by the Rubber Balloon  
Method

D2216-10.....Standard Test Methods for Laboratory  
Determination of Water (Moisture) Content of  
Soil and Rock by Mass

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D2974-07a.....Standard Test Methods for Moisture, Ash, and  
Organic Matter of Peat and Other Organic Soils  
D3666-11.....Standard Specification for Minimum Requirements  
for Agencies Testing and Inspecting Road and  
Paving Materials  
D3740-11.....Standard Practice for Minimum Requirements for  
Agencies Engaged in Testing and/or Inspection  
of Soil and Rock as used in Engineering Design  
and Construction  
D6938-10.....Standard Test Method for In-Place Density and  
Water Content of Soil and Soil-Aggregate by  
Nuclear Methods (Shallow Depth)  
E94-04(2010).....Standard Guide for Radiographic Examination  
E164-08.....Standard Practice for Contact Ultrasonic  
Testing of Weldments  
E329-11c.....Standard Specification for Agencies Engaged in  
Construction Inspection, Testing, or Special  
Inspection  
E543-09.....Standard Specification for Agencies Performing  
Non-Destructive Testing  
E605-93(R2011).....Standard Test Methods for Thickness and Density  
of Sprayed Fire Resistive Material (SFRM)  
Applied to Structural Members  
E709-08.....Standard Guide for Magnetic Particle  
Examination  
E1155-96(R2008).....Determining FF Floor Flatness and FL Floor  
Levelness Numbers  
E. American Welding Society (AWS):  
D1.D1.1M-10.....Structural Welding Code-Steel

### **1.3 REQUIREMENTS**

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority, and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications.  
Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Resident Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Resident Engineer to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to Resident Engineer, Contractor, unless other arrangements are agreed to in writing by the Resident Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to Resident Engineer immediately of any irregularity.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.1 STRUCTURAL STEEL**

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
- B. Prefabrication Inspection:
  - 1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
  - 2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
  - 3. Approve welder qualifications by certification or retesting.

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4. Approve procedure for control of distortion and shrinkage stresses.
5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.

C. Fabrication and Erection:

1. Weld Inspection:

- a. Inspect welding equipment for capacity, maintenance and working condition.
- b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
- c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
- d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
- e. Measure 25 percent of fillet welds.
- f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
  - 1) 20 percent of all shear plate fillet welds at random, final pass only.
  - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
  - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
  - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
  - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
- g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
- h. Verify that correction of rejected welds are made in accordance with AWS D1.1.
- i. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.

2. Bolt Inspection:

- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
  - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
  - c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
  - d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
  - e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
  - f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to Resident Engineer.

**3.2 SPRAYED-ON FIREPROOFING**

- A. Provide field inspection and testing services to certify sprayed-on fireproofing has been applied in accordance with contract documents.
- B. Obtain a copy of approved submittals from Resident Engineer.
- C. Use approved installation in test areas as criteria for inspection of work.
- D. Test sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
  1. Thickness gauge specified in ASTM E605 may be modified for pole extension so that overhead sprayed material can be reached from floor.

E. Location of test areas for field tests as follows:

1. Thickness: Select one bay per floor, or one bay for each 930 m<sup>2</sup> (10,000 square feet) of floor area, whichever provides for greater number of tests. Take thickness determinations from each of following locations: Metal deck, beam, and column.
2. Density: Take density determinations from each floor, or one test from each 930 m<sup>2</sup> (10,000 square feet) of floor area, whichever provides for greater number of tests, from each of the following areas: Underside of metal deck, beam flanges, and beam web.

F. Submit inspection reports, certification, and instances of noncompliance to Resident Engineer.

**3.3 TYPES OF TESTS**

Approximate Number of Tests Required

A. Structural Steel:

Ultrasonic Testing of Welds (ASTM E164)	_____
Magnetic Particle Testing of Welds (ASTM E709)	_____
Radiographic Testing of Welds (ASTM E94)	_____

B. Sprayed-On Fireproofing:

Thickness and Density Tests (ASTM E605)	_____
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C. Inspection:

Technical Personnel (Man-days)	_____
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**SECTION 01 57 19**  
**TEMPORARY ENVIRONMENTAL CONTROLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
  - 1. Adversely affect human health or welfare,
  - 2. Unfavorably alter ecological balances of importance to human life,
  - 3. Effect other species of importance to humankind, or;
  - 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
  - 1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
  - 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
  - 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
  - 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
  - 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.

6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.
7. Sanitary Wastes:
  - a. Sewage: Domestic sanitary sewage and human and animal waste.
  - b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

#### **1.2 QUALITY CONTROL**

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

#### **1.3 REFERENCES**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA):  
33 CFR 328.....Definitions

#### **1.4 SUBMITTALS**

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
  1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Resident Engineer to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Resident Engineer for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
    - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
    - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
    - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
    - d. Description of the Contractor's environmental protection personnel training program.

- e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
  - f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
  - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
  - h. Permits, licenses, and the location of the solid waste disposal area.
  - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
  - j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
  - k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

### **1.5 PROTECTION OF ENVIRONMENTAL RESOURCES**

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the Resident Engineer. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
  - 1. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
  - 2. Store chemical waste away from the work areas in corrosion-resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
  - 3. Handle discarded materials other than those included in the solid waste category as directed by the Resident Engineer.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
  - 1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
  - 2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
  - 3. Monitor water areas affected by construction.

- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of Pennsylvania Air Pollution Statutes and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
  2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
  3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
  4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

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

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

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

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

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

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

- b. Use shields or other physical barriers to restrict noise transmission.

- c. Provide soundproof housings or enclosures for noise-producing machinery.
  - d. Use efficient silencers on equipment air intakes.
  - e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
  - f. Line hoppers and storage bins with sound deadening material.
  - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the Aweighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the Resident Engineer noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the Resident Engineer. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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**SECTION 01 58 16**  
**TEMPORARY INTERIOR SIGNAGE**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies temporary interior signs.

**PART 2 PRODUCTS**

**2.1 TEMPORARY SIGNS**

- A. Fabricate from 50 Kg (110 pound) mat-finish white paper.
- B. Cut to 100 mm (4-inch) wide by 300 mm (12 inch) long size tag.
- C. Punch 3 mm (1/8-inch) diameter hole centered on 100 mm (4-inch) dimension of tag. Edge of Hole spaced approximately 13 mm (1/2-inch) from one end on tag.
- D. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.
- E. Ties: Steel wire 0.3 mm (0.0120-inch) thick, attach to tag with twist tie, leaving 150 mm (6-inch) long free ends.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.
- B. Mark on signs with felt tip marker having approximately 3 mm (1/8-inch) wide stroke for clearly legible numbers or letters.
- C. Identify room with numbers as designated on floor plans.

**3.2 LOCATION**

- A. Install on doors that have room, corridor, and space numbers shown.
- B. Doors that do not require signs are as follows:
1. Corridor barrier doors (cross-corridor) in corridor with same number.
  2. Folding doors or partitions.
  3. Toilet or bathroom doors within and between rooms.
  4. Communicating doors in partitions between rooms with corridor entrance doors.
  5. Closet doors within rooms.
- C. Replace missing, damaged or illegible signs.

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**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
  - 1. Waste Management Plan development and implementation.
  - 2. Techniques to minimize waste generation.
  - 3. Sorting and separating of waste materials.
  - 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.
  - 4. Green waste (biodegradable landscaping materials).
  - 5. Engineered wood products (plywood, particle board and I-joists, etc).
  - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
  - 7. Cardboard, paper and packaging.
  - 8. Bitumen roofing materials.
  - 9. Plastics (eg, ABS, PVC).
  - 10. Carpet and/or pad.
  - 11. Gypsum board.
  - 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.
  - 4. Construction error.
  - 5. Over ordering.
  - 6. Weather damage.
  - 7. Contamination.
  - 8. Mishandling.
  - 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.cwm.wbdg.org> 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 RECORDS**

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

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

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

## **PART 3 - EXECUTION**

### **3.1 COLLECTION**

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

### **3.2 DISPOSAL**

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



### 3.3 REPORT

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, including but not limited to dates removed, transportation costs, weight tickets, tipping fees, manifests and invoices. Include the net total costs for each disposal.

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**SECTION 01 91 00**

**GENERAL COMMISSIONING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 07, Division 14, Division 21, Division 23, Division 26, Division 27, and Division 28 series sections of these specifications are intended to be provided in coordination with the commissioning services, and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 07, Division 14, Division 21, Division 23, Division 26, Division 27 and Division 28 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.

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

1. Verify that the applicable equipment and systems are installed in accordance with the 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.

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

## **1.2 CONTRACTUAL RELATIONSHIPS**

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

- B. In this structure, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Resident Engineer and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the Resident Engineer and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the Resident Engineer.
- C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc) is essential to the success of the Commissioning effort.
- D. With these fundamental practices in mind, the commissioning process described herein has been developed to recognize that, in the execution of the Commissioning Process, the Commissioning Agent must develop effective methods to communicate with every member of the construction team involved in delivering commissioned systems while simultaneously respecting the exclusive contract authority of the Contracting Officer and Resident Engineer. Thus, the procedures outlined in this specification must be executed within the following limitations:
  - 1. No communications (verbal or written) from the Commissioning Agent shall be deemed to constitute direction that modifies the terms of any contract between the Department of Veterans Affairs and the Contractor.
  - 2. Commissioning Issues identified by the Commissioning Agent will be delivered to the Resident Engineer and copied to the designated Commissioning Representatives for the Contractor and subcontractors on the Commissioning Team for information only in order to expedite the communication process. These issues must be understood as the professional opinion of the Commissioning Agent and as suggestions for resolution.

3. In the event that any Commissioning Issues and suggested resolutions are deemed by the Resident Engineer to require either an official interpretation of the construction documents or require a modification of the contract documents, the Contracting Officer or Resident Engineer will issue an official directive to this effect.
4. All parties to the Commissioning Process shall be individually responsible for alerting the Resident Engineer of any issues that they deem to constitute a potential contract change prior to acting on these issues.
5. Authority for resolution or modification of design and construction issues rests solely with the Contracting Officer or Resident Engineer, with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

#### **1.3 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 32.16.15, PROJECT SCHEDULES.
- C. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- D. Section 07 08 00, FACILITY EXTERIOR CLOSURE COMMISSIONING.
- E. Section 21 08 00, COMMISSIONING OF FIRE PROTECTION SYSTEMS.
- F. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- G. Section 26 08 00, COMMISSIONING OF ELECTRICAL SYSTEMS.

#### **1.4 SUMMARY**

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

## 1.5 ACRONYMS

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

List of Acronyms	
Acronym	Meaning
SO	Site Observation
TAB	Test Adjust and Balance
VA	Department of Veterans Affairs
VAMC	VA Medical Center
VA CFM	VA Office of Construction and Facilities Management
VACO	VA Central Office
VA PM	VA Project Manager
VA-RE	VA Resident Engineer
USGBC	United States Green Building Council

## 1.6 DEFINITIONS

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Deficiency:** See "Commissioning Issue".

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

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

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

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

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

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

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

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

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

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

**Integrated System Testing:** Integrated Systems Testing procedures entail testing of multiple integrated systems performance to verify proper functional interface between systems. Typical Integrated Systems Testing includes verifying that building systems respond properly to

loss of utility, transfer to emergency power sources, re-transfer from emergency power source to normal utility source; interface between HVAC controls and Fire Alarm systems for equipment shutdown, interface between Fire Alarm system and elevator control systems for elevator recall and shutdown; interface between Fire Alarm System and Security Access Control Systems to control access to spaces during fire alarm conditions; and other similar tests as determined for each specific project.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. First party validation occurs when a firm or individual verifying the task is the same firm or individual performing the task.
2. Second party validation occurs when the firm or individual verifying the task is under the control of the firm performing the task or has

other possibilities of financial conflicts of interest in the resolution (Architects, Designers, General Contractors and Third Tier Subcontractors or Vendors).

3. Third party validation occurs when the firm verifying the task is not associated with or under control of the firm performing or designing the task.

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

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

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

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

#### **1.7 SYSTEMS TO BE COMMISSIONED**

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



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

<b>Systems To Be Commissioned</b>	
<b>System</b>	<b>Description</b>
<b>Building Exterior Closure</b>	
Exterior Closure	Exterior walls, exterior windows, exterior doors, louvers, grilles and sunscreens
Note:	The emphasis on commissioning the above building envelope systems is on control of air flow, heat flow, noise, infrared, ultraviolet, rain penetration, moisture, durability, security, reliability, constructability, maintainability and sustainability.
<b>Conveying Equipment</b>	
Elevators	Interface with other systems (fire alarm, etc.) [ASTM testing and certification by others]
<b>Fire Suppression</b>	
Fire Sprinkler Systems	Wet pipe system, dry pipe system, pre-action system, special agent systems
<b>HVAC</b>	
Steam/Heating Hot Water System	Boilers, boiler feed water system, economizers/heat recovery equipment, condensate recovery, water treatment, boiler fuel system, controls, interface with facility DDC system.
HVAC Air Handling Systems	Air handling Units, packaged rooftop AHU, Outdoor Air conditioning units, humidifiers, DDC control panels
HVAC Ventilation/Exhaust Systems	General exhaust, toilet exhaust, laboratory exhaust, isolation exhaust, room pressurization control systems
HVAC Terminal Unit Systems	VAV Terminal Units, CAV terminal units, fan coil units, fin-tube radiation, unit heaters
Decentralized Unitary HVAC Systems	Split-system HVAC systems, controls, interface with facility DDC

<b>Systems To Be Commissioned</b>	
<b>System</b>	<b>Description</b>
Smoke Evacuation System	Smoke evacuation and smoke management systems, controls, interface with other systems (fire alarm), emergency operation.
<b>Electrical</b>	
Grounding & Bonding Systems	Witness 3rd party testing, review reports
Emergency Power Generation Systems	Generators, Generator paralleling switchgear, automatic transfer switches, PLC and other control systems
Lighting & Lighting Control Systems	Emergency lighting, occupancy sensors, lighting control systems, architectural dimming systems
<b>Electronic Safety and Security</b>	
Physical Access Control Systems	Witness 3rd party testing, review reports
Video Surveillance System	Witness 3rd party testing, review reports
Fire Detection and Alarm System	100% device acceptance testing, battery draw-down test, verify system monitoring, verify interface with other systems.
<b>Integrated Systems Tests</b>	
Loss of Power Response	Loss of power to building, loss of power to campus, restoration of power to building, restoration of power to campus.
Fire Alarm Response	Integrated System Response to Fire Alarm Condition and Return to Normal

#### 1.8 COMMISSIONING TEAM

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

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B. Members Appointed by Contractor:

1. Contractor' Commissioning Manager: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.
2. Contractor's Commissioning Representative(s): Individual(s), each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions.

C. Members Appointed by VA:

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

**1.9 VA'S COMMISSIONING RESPONSIBILITIES**

- A. Appoint an individual, company or firm to act as the Commissioning Agent.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
  1. Coordination meetings.
  2. Training in operation and maintenance of systems, subsystems, and equipment.
  3. Testing meetings.
  4. Witness and assist in Systems Functional Performance Testing.
  5. Demonstration of operation of systems, subsystems, and equipment.
- C. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

#### **1.10 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES**

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

10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

#### **1.11 COMMISSIONING AGENT'S RESPONSIBILITIES**

- A. Organize and lead the commissioning team.
- B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.
- C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.
- D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.
- E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.
- F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.
- G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.
- H. Coordinate Systems Functional Performance Testing schedule with the Contractor.

- I. Witness selected systems startups.
- J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.
- K. Witness and document Systems Functional Performance Testing.
- L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.
- M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.
- N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.
- O. Prepare commissioning Field Observation Reports.
- P. Prepare the Final Commissioning Report.
- Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.
- R. Assemble the final commissioning documentation, including the Final Commissioning Report and Addendum to the Final Commissioning Report.

#### **1.12 COMMISSIONING DOCUMENTATION**

- A. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:
  - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes.

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- Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
  3. Identification of systems and equipment to be commissioned.
  4. Schedule of Commissioning Coordination meetings.
  5. Identification of items that must be completed before the next operation can proceed.
  6. Description of responsibilities of commissioning team members.
  7. Description of observations to be made.
  8. Description of requirements for operation and maintenance training.
  9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
  10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
  11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
  12. Preliminary Systems Functional Performance Test procedures.
- B. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:
1. Name and identification code of tested system.
  2. Test number.
  3. Time and date of test.

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4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
  5. Dated signatures of the person performing test and of the witness, if applicable.
  6. Individuals present for test.
  7. Observations and Issues.
  8. Issue number, if any, generated as the result of test.
- C. Pre-Functional Checklists: The Commissioning Agent will prepare Pre-Functional Checklists. Pre-Functional Checklists shall be completed and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.
- D. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.
- E. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results.
- F. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are



encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.

1. Creating a Commissioning Issues Log Entry:

- a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
- b. Assign a descriptive title for the issue.
- c. Identify date and time of the issue.
- d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
- e. Identify system, subsystem, and equipment to which the issue applies.
- f. Identify location of system, subsystem, and equipment.
- g. Include information that may be helpful in diagnosing or evaluating the issue.
- h. Note recommended corrective action.
- i. Identify commissioning team member responsible for corrective action.
- j. Identify expected date of correction.
- k. Identify person that identified the issue.

2. Documenting Issue Resolution:

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

G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have

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

1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
2. Commissioning plan.
3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
5. Commissioning Issues Log.
6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.

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

1. Documentation of deferred and off season test(s) results.
2. Completed Systems Functional Performance Test Procedures for off season test(s).
3. Documentation that unresolved system performance issues have been resolved.
4. Updated Commissioning Issues Log, including status of unresolved issues.

5. Identification of potential Warranty Claims to be corrected by the Contractor.
- I. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual. The Systems Manual will include, but is not limited to, the following:
  1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.
  2. Reference to Final Commissioning Plan.
  3. Reference to Final Commissioning Report.
  4. Approved Operation and Maintenance Data as submitted by the Contractor.

#### **1.13 SUBMITTALS**

- A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:
  1. The Commissioning Team: A list of commissioning team members by organization.
  2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
  3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
  4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.
  5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.

6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.
- B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.
- C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.
- D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.
- E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.
- F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA Resident Engineer with copies to the Contractor and Architect.

- G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three electronic copies of the preliminary commissioning report. One electronic copy, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.
- H. Final Commissioning Report Submittal: The Commissioning Agent will submit four sets of electronically formatted information of the final commissioning report to the VA. The final submittal will incorporate comments as directed by the VA.
- I. Data for Commissioning:
  - 1. The Commissioning Agent will request in writing from the Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Commissioning Plan.
  - 2. The Commissioning Agent may request further documentation as is necessary for the commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.

#### **1.14 COMMISSIONING PROCESS**

- A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.
- B. Within 45 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CM) to manage and lead the commissioning effort on behalf of the Contractor. The Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.
- C. Within 45 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CR) to be responsible for commissioning-related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team

members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

#### **1.15 QUALITY ASSURANCE**

- A. Instructor Qualifications: Factory authorized service representatives shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: The Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

#### **1.16 COORDINATION**

- A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- B. Scheduling: The Contractor will work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.
- C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As

construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.

- D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
- E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.
- F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

- A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing. Test equipment required for Systems Functional Performance Testing will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.
- B. Data logging equipment and software required to test equipment shall be provided by the Contractor.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 °C (1.0 °F) and a resolution of + or - 0.1 °C (0.2 °F). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's

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recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.



**PART 3 - EXECUTION**

**3.1 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES**

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

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



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



<b>Construction Phase</b>		CxA = Commissioning Agent					L = Lead
		RE = Resident Engineer					P = Participate
		A/E = Design Arch/Engineer					A = Approve
		PC = Prime Contractor					R = Review
		O&M = Gov't Facility O&M					O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Activities							
Reports and Logs	Status Reports	L	A	R	R	O	
	Maintain Commissioning Issues Log	L	A	R	R	O	

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

<b>Acceptance Phase</b>		CxA = Commissioning Agent					L = Lead
		RE = Resident Engineer					P = Participate
		A/E = Design Arch/Engineer					A = Approve
		PC = Prime Contractor					R = Review
		O&M = Gov't Facility O&M					O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Meetings	Commissioning Meetings	L	A	P	P	O	
	Project Progress Meetings	P	A	P	L	O	
	Pre-Test Coordination Meeting	L	A	P	P	O	
	Lessons Learned and Commissioning Report Review Meeting	L	A	P	P	O	



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





<b>Acceptance Phase</b>		CxA = Commissioning Agent RE = Resident Engineer A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M							L = Lead P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes		
Functional Test Protocols	TAB Verification	L	A	R	R	O			
	Systems Functional Performance Testing	L	A	P	P	P			
	Retesting	L	A	P	P	P			
Technical Activities	Issues Resolution Meetings	P	A	P	L	O			
	Systems Training	L	S	R	P	P			
Reports and Logs	Status Reports	L	A	R	R	O			
	Maintain Commissioning Issues Log	L	A	R	R	O			
	Final Commissioning Report	L	A	R	R	R			
	Prepare Systems Manuals	L	A	R	R	R			



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

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



### **3.2 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS**

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

1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.

a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.

b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.

2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.

a. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.

b. The full startup plan shall at a minimum consist of the following items:

1) The Pre-Functional Checklists.

2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.

- 3) The manufacturer's normally used field checkout sheets.
  - a) The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.
  - b) The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.
3. Sensor and Actuator Calibration
  - a. All field installed temperature, relative humidity, CO<sub>2</sub> and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 specifications.
  - b. All procedures used shall be fully documented on the Pre-Functional Checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
4. Execution of Equipment Startup
  - a. Four weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
  - b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
  - c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
  - d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

### **3.3 DEFICIENCIES, NONCONFORMANCE, AND APPROVAL IN CHECKLISTS AND STARTUP**

- A. The Contractor shall clearly list any outstanding items of the initial startup and Pre-Functional Checklist procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the VA and the Commissioning Agent within two days of completion.
- B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the VA and others as necessary. The Contractor shall correct all areas that are noncompliant or incomplete in the checklists in a timely manner, and shall notify the VA and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the original noncompliance report. When satisfactorily completed, the Commissioning Agent will recommend approval of the checklists and startup of each system to the VA.
- C. The Contractor shall be responsible for resolution of deficiencies as directed the VA.

### **3.4 PHASED COMMISSIONING**

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

### **3.5 DDC SYSTEM TRENDING FOR COMMISSIONING**

- A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.
- B. Alarms are a means to notify the system operator that abnormal conditions are present in the system. Alarms shall be structured into three tiers - Critical, Priority, and Maintenance.
  - 1. Critical alarms are intended to be alarms that require the immediate attention of and action by the Operator. These alarms shall be displayed on the Operator Workstation in a popup style window that

- is graphically linked to the associated unit's graphical display. The popup style window shall be displayed on top of any active window within the screen, including non DDC system software.
2. Priority level alarms are to be printed to a printer which is connected to the Operator's Work Station located within the engineer's office. Additionally Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from the operator or maintenance personnel within a normal work shift, and not immediate action.
  3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.
- C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more effectively program, view, manipulate and test control devices while being in the same room as the controlled device.
- D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the Resident Engineer and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:
1. Pre-testing, Testing, and Post-testing - Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical



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

to allow minor, short-duration events to be corrected by the DDC system prior to recording an alarm.

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
OA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Humidity	AI	15 Min	24 hours	3 days	P	>60% RH	10 min
Mixed Air Temp	AI	None	None	None	N/A		
SA Temp	AI	15 Min	24 hours	3 days	C	±5°F from SP	10 min
Supply Fan Speed	AI	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AI	15 Min	24 hours	3 days	N/A		
RA Pre-Filter Status	AI	None	None	None	N/A		
OA Pre-Filter Status	AI	None	None	None	N/A		
After Filter Status	AI	None	None	None	N/A		
SA Flow	AI	15 Min	24 hours	3 days	C	±10% from SP	10 min
OA Supply Temp	AI	15 Min	24 hours	3 days	P	±5°F from SP	10 min
RA Supply Temp	AI	15 Min	24 hours	3 days	N/A		
RA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA HW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
RA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
Initial UVC Intensity (%)	AI	None	None	None	N/A		
Duct Pressure	AI	15 Min	24 hours	3 days	C	±25% from SP	6 min
CO2 Level	AI	15 Min	24 hours	3 days	P	±10% from SP	10 min

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Supply Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Return Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 Min
High Static Status	DI	COV	24 hours	3 days	P	True	1 min
Fire Alarm Status	DI	COV	24 hours	3 days	C	True	5 min
Freeze Stat Level 1	DI	COV	24 hours	3 days	C	True	10 min
Freeze Stat Level 2	DI	COV	24 hours	3 days	C	True	5 min
Freeze Stat Level 3	DI	COV	24 hours	3 days	P	True	1 min
Fire/Smoke Damper Status	DI	COV	24 hours	3 days	P	Closed	1 min
Emergency AHU Shutdown	DI	COV	24 hours	3 days	P	True	1 min
Exhaust Fan #1 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #2 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #3 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
OA Alarm	DI	COV	24 hours	3 days	C	True	10 min
High Static Alarm	DI	COV	24 hours	3 days	C	True	10 min
UVC Emitter Alarm	DI	COV	24 hours	3 days	P	True	10 min
CO2 Alarm	DI	COV	24 hours	3 days	P	True	10 min
Power Failure	DI	COV	24 hours	3 days	P	True	1 min
Supply Fan Speed	AO	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AO	15 Min	24 hours	3 days	N/A		

Dual-Path Air Handling Unit Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
RA CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
OA CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
OA HW Valve Position	AO	15 Min	24 hours	3 days	N/A		
Supply Fan S/S	DO	COV	24 hours	3 days	N/A		
Return Fan S/S	DO	COV	24 hours	3 days	N/A		
Fire/Smoke Dampers	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
AHU Energy	Calc	1 Hour	30 day	N/A	N/A		

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

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

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

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

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

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

Domestic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Dom. Circ. Pump #2 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Dom. Circ. Pump #1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Dom. Circ. Pump #2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Domestic HW Start/Stop	DO	COV	12 Hours	3 days	N/A		

Hydronic Hot Water Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
System HWS Temperature	AI	15 min	12 hours	3 days	C	±5°F from SP	10 Min
System HWR Temperature	AI	15 min	12 hours	3 days	M	±15°F from SP	300 Min
HX-1 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Leaving Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
System Flow (GPM)	AI	15 min	12 hours	3 days	N/A		
System Differential Pressure	AI	15 min	12 hours	3 days	P	±10% from SP	8 Min
				3 days			
HW Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min



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

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

Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Secondary Loop Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Primary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Chiller 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 2 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 2 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 2 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Detector	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Exhaust Fan Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min

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

Condenser Water System Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 1 Condenser Entering Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Condenser Leaving Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Condenser Entering Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Condenser Leaving Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Basin Temp	AI	15 Minutes	12 Hours	3 days	P	< 45 oF	10 Min
Cooling Tower 2 Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Basin Temp	AI	15 Minutes	12 Hours	3 days	P	< 45 oF	10 Min
Condenser Water Supply Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Condenser Water Return Temp	AI	15 Minutes	12 Hours	3 days	N/A		
Outdoor Air Wet Bulb	AI	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Fan Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Cooling Tower 1 Basin Heat	DI	COV	12 Hours	3 days	N/A		
Cooling Tower 1 Heat Trace	DI	COV	12 Hours	3 days	N/A		
Cooling Tower 2 Fan Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Cooling Tower 2 Basin Heat	DI	COV	12 Hours	3 days	N/A		

Condenser Water System Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Cooling Tower 2 Heat Trace	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Isolation Valve	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Chiller 2 Isolation Valve	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Condenser Water Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Condenser Water Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	1 min
Chiller 1 Condenser Bypass Valve	AO	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Condenser By- Pass Valve	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Bypass Valve	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Fan Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Bypass Valve	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 2 Fan Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Cooling Tower 1 Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		
Cooling Tower 2 Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		
Condenser Water Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Condenser Water Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		

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

Condenser Water System Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Boiler 2 High Water Alarm	DI	COV	12 Hours	3 days	C	True	5 Min
Boiler 2 Feed Pump	DI	COV	12 Hours	3 days	N/A		
Combustion Damper Status	DI	COV	12 Hours	3 days	P	Status <> Command	5 min
Condensate Recovery Pump Status	DI	COV	12 Hours	3 days	P	Status <> Command	5 min
Boiler 1 Feed Pump Start / Stop	DO	COV	12 Hours	3 days	N/A		
Boiler 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Combustion Damper Command	DO	COV	12 Hours	3 days	N/A		
Condensate Recovery Pump Start / Stop	DO	COV	12 Hours	3 days	N/A		

Hot Water Boiler System Trending and Alarms							
Point	Type	Trend Interval	Operationa l Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Outside Air Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Entering Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Leaving Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		



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

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

E. The Contractor shall provide the following information prior to Systems Functional Performance Testing. Any documentation that is modified after submission shall be recorded and resubmitted to the Resident Engineer and Commissioning Agent.

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

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

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

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

### **3.6 SYSTEMS FUNCTIONAL PERFORMANCE TESTING**

- A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.
- B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.
- C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.

- D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form. Representative test formats and examples are found in the Commissioning Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms developed by the Commissioning Agent will include, but not be limited to, the following information:
1. System and equipment or component name(s)
  2. Equipment location and ID number
  3. Unique test ID number, and reference to unique Pre-Functional Checklists and startup documentation, and ID numbers for the piece of equipment.
  4. Date
  5. Project name
  6. Participating parties
  7. A copy of the specification section describing the test requirements
  8. A copy of the specific sequence of operations or other specified parameters being verified
  9. Formulas used in any calculations
  10. Required pretest field measurements
  11. Instructions for setting up the test.
  12. Special cautions, alarm limits, etc.
  13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
  14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
  15. A section for comments.
  16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.

E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.

1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.
2. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.

5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.
- F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.
- G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.
- H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- I. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days' notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.

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

### **3.7 DOCUMENTATION, NONCONFORMANCE AND APPROVAL OF TESTS**

- A. Documentation: The Commissioning Agent will witness, and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to the VA and the Contractor for review and approval. The Contractor shall include the filled out forms with the O&M manual data.
- B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the VA on Commissioning Field Reports and/or the Commissioning Master Issues Log.
1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and resolution shall be documented on the Systems Functional Test Procedure.
  2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy



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- scheduling or cost issues, unless there is an overriding reason to do so by direction from the VA.
3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.
  4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:
    - a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the Commissioning Agent will submit a Commissioning Field Report to the VA. The Commissioning Agent will also note items of noncompliance and the Contractor's response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the VA and the Commissioning Agent.
    - b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.
  5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:
    - a. The item of noncompliance shall be documented on the test form with the Contractor's response. The item of noncompliance with the Contractor's response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.
    - b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive and acceptance authority is with the Department of Veterans Affairs.
    - c. The Commissioning Agent will document the resolution process.
    - d. Once the interpretation and resolution have been decided, the Contractor shall correct the item of noncompliance, report it to the Commissioning Agent. The requirement for retesting will be

determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test. Retesting shall be repeated until satisfactory performance is achieved.

- C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- D. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform in compliance with the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the VA. In such case, the Contractor shall provide the VA with the following:
1. Within one week of notification from the VA, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the VA within two weeks of the original notice.
  2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
  3. The VA shall determine whether a replacement of all identical units or a repair is acceptable.
  4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.

5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

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

### **3.8 DEFERRED TESTING**

- A. Unforeseen Deferred Systems Functional Performance Tests: If any Systems Functional Performance Test cannot be completed due to the building structure, required occupancy condition or other conditions, execution of the Systems Functional Performance Testing may be delayed upon approval of the VA. These Systems Functional Performance Tests shall be conducted in the same manner as the seasonal tests as soon as possible. Services of the Contractor to conduct these unforeseen Deferred Systems Functional Performance Tests shall be negotiated between the VA and the Contractor.
- B. Deferred Seasonal Testing: Deferred Seasonal Systems Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Systems Functional Performance Tests should be deferred until weather conditions more closely match systems parameters. The Contractor shall review and comment on the proposed schedule for Deferred Seasonal Testing. The VA will review and approve the schedule for Deferred Seasonal Testing. Deferred Seasonal Systems Functional Performances Tests shall be witnessed and documented by the Commissioning Agent. Deferred Seasonal Systems Functional Performance Tests shall be executed by the Contractor in accordance with these specifications.

### **3.9 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS**

- A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's Resident Engineer, VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.
- B. The Contractor shall provide training and demonstration as required by other Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 sections. The Training and Demonstration shall include, but is not limited to, the following:
  - 1. Review the Contract Documents.
  - 2. Review installed systems, subsystems, and equipment.
  - 3. Review instructor qualifications.
  - 4. Review instructional methods and procedures.
  - 5. Review training module outlines and contents.
  - 6. Review course materials (including operation and maintenance manuals).
  - 7. Review and discuss locations and other facilities required for instruction.
  - 8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
  - 9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
- C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:
  - 1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.
  - 2. Qualification Data: Submit qualifications for facilitator and/or instructor.

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

D. Quality Assurance:

1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

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

E. Training Coordination:

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

F. Instruction Program:

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

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- i. switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
  - j. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.
  - k. Lighting equipment and controls.
  - l. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.
  - m. Site utilities including lift stations, condensate pumping and return systems, and storm water pumping systems.
- G. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include instruction for the following:
- 1. Basis of System Design, Operational Requirements, and Criteria:  
Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Operations manuals.
    - c. Maintenance manuals.
    - d. Project Record Documents.
    - e. Identification systems.
    - f. Warranties and bonds.
    - g. Maintenance service agreements and similar continuing commitments.

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



- d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.
- H. Training Execution:
- 1. Preparation: Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual. Set up instructional equipment at instruction location.
  - 2. Instruction:
    - a. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Department of Veterans Affairs for number of participants, instruction times, and location.
    - b. Instructor: Engage qualified instructors to instruct VA's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
      - 1) The Commissioning Agent will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
      - 2) The VA will furnish an instructor to describe VA's operational philosophy.
      - 3) The VA will furnish the Contractor with names and positions of participants.

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3. Scheduling: Provide instruction at mutually agreed times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with the VA and the Commissioning Agent with at least seven days' advance notice.
4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of **an oral, or a written**, performance-based test.
5. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

I. Demonstration and Training Recording:

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

- - - END - - -

**SECTION 02 41 00**  
**DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies demolition and removal of portions of buildings, utilities, and other structures and debris.

**1.2 RELATED WORK**

- A. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- 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. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- G. Construction Waste Management: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- H. 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. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded, and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.
- H. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

#### **1.4 UTILITY SERVICES**

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

#### **PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 DEMOLITION**

- A. Completely demolish and remove portions of buildings and structures, including all appurtenances related or connected thereto, as noted below:
  - 1. As required for installation of new elevator cabs and utility service lines.
- B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor, and shall be disposed of by him daily, off the Medical Center Property to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Resident Engineer. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- C. In removing portions of buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to third floor level. Demolition of portions of first and second stories may proceed simultaneously.
- D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of Contractor, and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. The removal of hazardous material shall be referred to Hazardous Materials specifications.
- E. Remove existing utilities as indicated or uncovered by work, and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Resident Engineer. When Utility lines are encountered that are not indicated on the drawings, the Resident Engineer shall be notified prior to further work in that area.

**3.2 CLEAN-UP**

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

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**SECTION 02 82 11**  
**TRADITIONAL ASBESTOS ABATEMENT**

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**INSTRUCTIONS TO ARCHITECT/ENGINEER AND INDUSTRIAL HYGIENE CONSULTANT**

**SECTION 02 82 11**

**CLASS I NEGATIVE PRESSURE ENCLOSURE ASBESTOS ABATEMENT SPECIFICATIONS**

1. These specifications provide general guidance to personnel given the task of designing and executing a Class I negative pressure enclosure asbestos abatement project. Each abatement is a unique situation and therefore must be tailored for that project. This specification incorporates current regulatory requirements and current best abatement practices, procedures and technology. The Architect/Engineer and/or the Industrial Hygiene consultants may provide additional specification additions or deletions to this specification that, in their professional judgment, will ensure a safe and effective approach to a specific abatement project while maintaining compliance with applicable regulations and VA policy. Any changes must be clearly marked on/attached to this document prior to finalization of the specification so that the changes will be adequately considered in the review process by the VA.
2. These specifications are to be used in conjunction with asbestos abatement contractor selection criteria; special instructions package; and general construction provisions.
3. Paragraphs that are not preceded by a number code are indented as instructions to the specifications writer and identified by the notation "Spec Writer Notes". These paragraphs must be deleted from the final document.
4. Within the text of the specifications, there may be optional procedures which the specification writer could include in the final specification. Procedures which are not chosen must be deleted by the specification writer. Optional text is shown by the notation (//text//).
5. The specification writer, VPIH/CIH, CPIH/CIH, and A/E must be aware of and read the VA A/E Quality Alert 07/09 since it details common errors in specification and contract documents for asbestos project. This would be especially helpful if a survey is being conducted prior to an abatement project. A full AHERA survey of the facility would be needed prior to renovation activities, however, if demolition of the facility is planned, a NESHAP survey of the facility would need to be performed.

**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

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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. Below is a brief description of the estimated quantities of asbestos containing materials to be abated. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy 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;

- ( ) linear meters (feet) of <50 mm (2") diameter pipe insulation
- ( ) linear meters (feet) of 50 - 150 mm (2" - 6") diameter pipe insulation
- ( ) linear meters (feet) of >150 mm (6") diameter pipe insulation
- ( ) fittings 50 - 150 mm (2" - 6") in diameter
- ( ) square meters (feet) of boiler/tank insulation
  
- ( ) square meters (feet) of plaster ceiling/wall
- ( ) square meters (feet) of sprayed-on insulation
  
- ( ) cubic meters (feet) of contaminated soil/materials
- ( ) other // specify //

SPEC WRITER NOTE: Provide the approximate quantities for removal, encapsulation of ACM and enclosure of ACM in the same format as shown for removal/disposal of ACM/ACE. It may be helpful to the offeror to specify the type of pipe and boiler insulation (e.g., aircell, magnesium silicate)

//C. Encapsulation of ACM in the following quantities://

//D. Enclosure of ACM in the following quantities://

### 1.1.3 RELATED WORK

- A. Section 07 84 00, FIRESTOPPING.
- B. Section 02 41 00, DEMOLITION.
- C. Division 09, FINISHES.
- D. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION / Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- E. Section 23 07 11, HVAC INSULATION.
- F. Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.
- G. Section 23 31 00, HVAC DUCTS AND CASINGS.

### 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 CONTRACTOR'S 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.

### 1.2 VARIATIONS IN QUANTITY

- A. The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 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 ACMs, 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.

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

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

**Air monitoring** - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 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 that isolates the regulated area and inhibits fiber migration from the regulated area.

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

**Critical Barrier** - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of 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/marked 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 impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

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

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

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

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

**Friable asbestos containing material** - Any material containing more than one (1) percent or 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 on-going 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
  - 6. Title 29 CFR 1910.1200 - Hazard Communication
  - 7. Title 29 CFR 1910 Subpart K - Medical and First Aid
- B. Environmental Protection Agency (**EPA**):
  - 1. 40 CFR 61 Subpart A and M (Revised Subpart B) - National Emission Standard for Hazardous Air Pollutants - Asbestos.
  - 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**

- A. Comply with all state regulations, statutes or guidance documents that apply to the asbestos abatement work, disposal, clearance, etc.

#### **1.5.5 LOCAL REQUIREMENTS**

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

#### **1.5.6 STANDARDS**

- A. Standards which govern asbestos abatement activities include, but are not limited to, the following:
  - 1. American National Standards Institute (ANSI) Z9.2-79 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI Z88.2 - Practices for Respiratory Protection.
  - 2. Underwriters Laboratories (UL) 586-90 - UL Standard for Safety of HEPA Filter Units, 7th Edition.
- 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. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
  - 2. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
  - 3. NFPA 101 - Life Safety Code.

#### **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:

- 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.
- J. Emergency Action Plan and Contingency Plan Procedures.
- K. Proof of assurance that all State and Local requirements have been submitted and will be complied with.

## 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 face-piece 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-OPTS-86-001 "A Guide to Respiratory Protection for the Asbestos Abatement Industry". The competent person on site will be responsible for the supplied air system to ensure the safety of the worker.

### **1.8 WORKER PROTECTION**

#### **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 face-piece 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 face-piece 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.

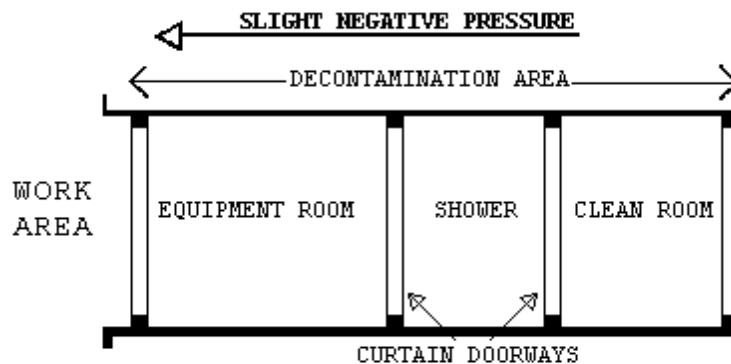
#### **1.9.4 PERSONNEL DECONTAMINATION FACILITY (PDF)**

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.

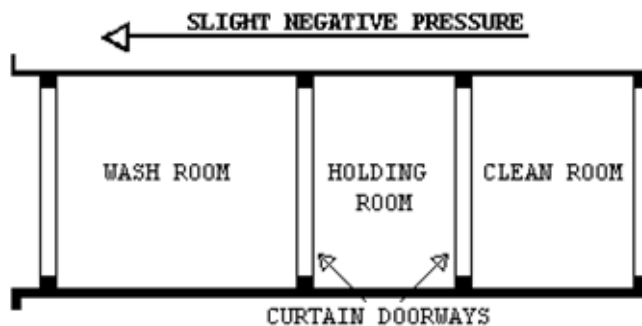


#### 1.9.5 WASTE/EQUIPMENT DECONTAMINATION FACILITY (W/EDF)

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. No fewer than two personal samples per shift shall be collected and one area sample per 1,000 square feet of regulated area where abatement is taking place and one sample per shift in the clean room area shall be collected. In addition to the continuous monitoring required, the CPIH/CIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities. Additionally, the CPIH/CIH will monitor and record pressure readings within the containment daily with a minimum of two readings at the beginning and at the end of a shift, and submit the data in the daily report.

### **2.3 ASBESTOS HAZARD ABATEMENT PLAN**

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.

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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 breeching, equipment failures, emergencies, and any cause for stopping work; and representative air monitoring and results/TWA's/EL's. Submit this information daily to the 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.
  3. Packaging and removal of ACM waste from regulated area.
  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 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.
  2. University of Pittsburgh Protocol: Combustion Toxicity; zero mortality.
  3. ASTM C732: Accelerated Aging Test; Life Expectancy - 20 years.
  4. ASTM E96: Permeability - minimum of 0.4 perms.
- B. Bridging/Penetrating Encapsulants:
1. ASTM E736: Cohesion/Adhesion Test - 24 kPa (50 lbs/ft<sup>2</sup>).
  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/ft<sup>2</sup>) (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 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 ~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 CFM under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan must be a centrifugal type fan.
- C. Negative Air Machine Final Filter: The final filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an air tight seal. Each HEPA filter shall be certified by the manufacturer to have an efficiency of not less than 99.97%. 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.

Contractor shall 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.

Contractor shall 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 VA A/E Quality Alert 07/09 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.
- 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. If required by project conditions, locations of amosite ACM will require local exhaust ventilation and collection as described below, in addition to wet removal.
- 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 VPIH/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 crawlspaces or pipe tunnels, remove all visible asbestos debris using wet methods (if possible) after set-up of PDF, W/EDF, and after establishing negative air systems as required. Perform work and decontaminate/clean-up; perform lockdown as needed and complete work as required in these specifications. The asbestos contaminated soil (ACS) shall be removed and/or enclosed. Clearance requirements include confirmation sampling of affected soil by Polarized Light Microscopy (PLM). Clearance sampling requirements are specified in Sections 3.6.4 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 be 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 piping after all ACM has been removed. Apply in strict accordance with the manufacturer's instructions. Any deviation from the instructions must be approved by the VA's representative in writing prior to commencing the work.
- 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 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/mm<sup>2</sup>) 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/mm<sup>2</sup>) 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 approval. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.





**ATTACHMENT #1**

**CERTIFICATE OF COMPLETION**

DATE: \_\_\_\_\_ VA Project #: \_\_\_\_\_

PROJECT NAME: \_\_\_\_\_ Abatement Contractor: \_\_\_\_\_

VAMC/ADDRESS: \_\_\_\_\_

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):  
which took place from        /        /        to        /        /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer's recommendations.

CPIH/CIH Signature/Date: \_\_\_\_\_

CPIH/CIH Print Name: \_\_\_\_\_

Abatement Contractor Signature/Date: \_\_\_\_\_

Abatement Contractor Print Name: \_\_\_\_\_



**ATTACHMENT #2**

**CERTIFICATE OF WORKER'S ACKNOWLEDGMENT**

PROJECT NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

PROJECT ADDRESS: \_\_\_\_\_

ABATEMENT CONTRACTOR'S NAME: \_\_\_\_\_

**WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.**

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32 hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

- Physical Characteristics and Background Information on Asbestos
- Potential Health Effects Related to Exposure to Asbestos
- Employee Personal Protective Equipment
- Establishment of a Respiratory Protection Program
- State of the Art Work Practices
- Personal Hygiene
- Additional Safety Hazards
- Medical Monitoring
- Air Monitoring
- Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
- Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Social Security Number: \_\_\_\_\_

Witness: \_\_\_\_\_



**ATTACHMENT #3**

**AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION**

VA PROJECT NAME AND NUMBER: \_\_\_\_\_

VA MEDICAL FACILITY: \_\_\_\_\_

ABATEMENT CONTRACTOR'S NAME AND ADDRESS: \_\_\_\_\_

1. I verify that the following individual

Name: \_\_\_\_\_ Social Security Number: \_\_\_\_\_

who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.

Address: \_\_\_\_\_

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH: \_\_\_\_\_ Date: \_\_\_\_\_

Printed Name of CPIH/CIH: \_\_\_\_\_

Signature of Contractor: \_\_\_\_\_ Date: \_\_\_\_\_

Printed Name of Contractor: \_\_\_\_\_



**ATTACHMENT #4**

**ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S  
ASBESTOS SPECIFICATIONS**

VA Project Location: \_\_\_\_\_

VA Project #: \_\_\_\_\_

VA Project Description: \_\_\_\_\_

This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature \_\_\_\_\_ Date \_\_\_\_\_

Abatement Contractor Competent Person(s) \_\_\_\_\_ Date \_\_\_\_\_

- - - END - - -





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

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies abatement and disposal of lead-based paint (LBP), and controls needed to limit occupational and environmental exposure to lead hazards.

**1.2 RELATED WORK**

- A. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.  
B. Section 02 41 00, DEMOLITION.  
C. Section 09 91 00, PAINTING.

**1.3 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. Code of Federal Regulations (CFR):
- CFR 29 Part 1910.....Occupational Safety and Health Standards  
CFR 29 Part 1926.....Safety and Health Regulations for Construction  
CFR 40 Part 148.....Hazardous Waste Injection Restrictions  
CFR 40 Part 260.....Hazardous Waste Management System: General  
CFR 40 Part 261.....Identification and Listing of Hazardous Waste  
CFR 40 Part 262.....Standards Applicable to Generators of Hazardous Waste  
CFR 40 Part 263.....Standards Applicable to Transporters of Hazardous Waste  
CFR 40 Part 264.....Standards for Owners and Operations of Hazardous Waste Treatment, Storage, and Disposal Facilities  
CFR 40 Part 265.....Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities  
CFR 40 Part 268.....Land Disposal Restrictions  
CFR 49 Part 172.....Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements  
CFR 49 Part 178.....Specifications for Packaging

- C. National Fire Protection Association (NFPA):  
NFPA 701-2004.....Methods of Fire Test for Flame-Resistant  
Textiles and Films
- D. National Institute for Occupational Safety And Health (NIOSH)  
NIOSH OSHA Booklet 3142.       Lead in Construction
- E. Underwriters Laboratories (UL)  
UL 586-1996 (Rev 2009)..       High-Efficiency, Particulate, Air Filter  
Units
- F. American National Standards Institute  
Z9.2-2006.....Fundamentals Governing the Design and Operation  
of Local Exhaust Systems  
Z88.6-2006.....Respiratory Protection

#### **1.4 DEFINITIONS**

- A. Action Level: Employee exposure, without regard to use of respirations, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period. As used in this section, "30 micrograms per cubic meter of air" refers to the action level.
- B. Area Monitoring: Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations which may reach the breathing zone of personnel potentially exposed to lead.
- C. Physical Boundary: Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean the same as "outside lead control area."
- D. Certified Industrial Hygienist (CIH): As used in this section, refers to an Industrial Hygienist employed by the Contractor and is certified by the American Board of Industrial Hygiene in comprehensive practice.
- E. Change Rooms and Shower Facilities: Rooms within the designated physical boundary around the 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: A person capable of identifying lead hazards in the work area and is authorized by the 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 an 8-hour workday to which an employee is exposed.
- I. High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron 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: An enclosed area or structure with full containment to prevent the spread of lead dust, paint chips, or debris of lead-containing paint removal operations. The lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.
- L. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1910.1025. If an employee is exposed for more than 8 hours in a work day, the PEL shall be determined by the following formula. 
$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. of hrs worked per day}$$
- M. Personnel Monitoring: Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1910.1025. Samples shall be representative of the employee's work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 150 mm to 225 mm (6 to 9 inches) and the center at the nose or mouth of an employee.

#### **1.5 QUALITY ASSURANCE**

- A. Before exposure to lead-contaminated dust, provide workers with a comprehensive medical examination as required by 29 CFR 1926.62 (I) (1) (i) & (ii). The examination shall not be required if adequate records show that employees have been examined as required by 29 CFR 1926.62(I) without the last year.
- B. Medical Records: Maintain complete and accurate medical records of employees in accordance with 29 CFR 1910.20.

- C. CIH Responsibilities: The Contractor shall employ a certified Industrial Hygienist who will be responsible for the following:
1. Certify Training.
  2. Review and approve lead-containing paint removal plan for conformance to the applicable referenced standards.
  3. Inspect lead-containing paint removal work for conformance with the approved plan.
  4. Direct monitoring.
  5. Ensure work is performed in strict accordance with specifications at all times.
  6. Ensure hazardous exposure to personnel and to the environment are adequately controlled at all times.
- D. Training: Train each employee performing paint removal, disposal, and air sampling operations prior to the time of initial job assignment, in accordance with 29 CFR 1926.62.
- E. Training Certification: Submit certificates signed and dated by the CIH and by each employee stating that the employee has received training.
- F. Respiratory Protection Program:
1. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at least every 6 months thereafter as required by 29 CFR 1926.62.
  2. Establish and implement a respiratory protection program as required by 29 CFR 1910.134, 29 CFR 1910.1025, and 29 CFR 1926.62.
- G. Hazard Communication Program: Establish and implement a Hazard Communication Program as required by 29 CFR 1910.1200.
- H. Hazardous Waste Management: The Hazardous Waste Management plan shall comply with applicable requirements of Federal, State, and local hazardous waste regulations and address:
1. Identification of hazardous wastes associated with the work.
  2. Estimated quantities of wastes to be generated and disposed of.
  3. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24-hour point of contact. Furnish 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 who will be working on-site with hazardous wastes.
  5. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
  6. Spill prevention, containment, and cleanup contingency measures to be implemented.
  7. Work plan and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily.
  8. Cost for hazardous waste disposal according to this plan.
- I. Safety and Health Compliance:
1. In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, and local authorities regarding removing, handling, storing, transporting, and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1910.1025. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work.
  2. Where specification requirements and the referenced documents vary, the most stringent requirements shall apply.
- J. Pre-Construction Conference: Along with the CIH, meet with the Contracting Officer to discuss in detail the lead-containing paint removal work plan, including work procedures and precautions for the work plan.

#### **1.6 SUBMITTALS**

- A. Submit the following in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Catalog Data:  
Vacuum filters  
Respirators
- C. Instructions: Paint removal materials. Include applicable material safety data sheets.

D. Statements Certifications and Statements:

1. Qualifications of CIH: Submit name, address, and telephone number of the CIH selected to perform responsibilities in paragraph entitled "CIH Responsibilities." Provide previous experience of the CIH. Submit proper documentation that the Industrial Hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification.
2. Testing Laboratory: Submit the name, address, and telephone number of the testing laboratory selected to perform the monitoring, testing, and reporting of airborne concentrations of lead. Provide proper documentation that persons performing the analysis have been judged proficient by successful participation within the last year in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) Program. The laboratory shall be accredited by the American Industrial Hygiene Association (AIHA). Provide AIHA documentation along with date of accreditation/reaccreditation.
3. Lead-Containing Paint Removal Plan:
  - a. Submit a detailed job-specific plan of the work procedures to be used in the removal of lead-containing paint. The plan shall include a sketch showing the location, size, and details of lead control areas, location and details of decontamination rooms, change rooms, shower facilities, and mechanical ventilation system.
  - b. Include in the plan, eating, drinking, smoking and restroom procedures, interface of trades, sequencing of lead related work, collected wastewater and paint debris disposal plan, air sampling plan, respirators, protective equipment, and a detailed description of the method of containment of the operation to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air are not exceeded outside of the lead control area.
  - c. Include air sampling, training and strategy, sampling methodology, frequency, duration of sampling, and qualifications of air monitoring personnel in the air sampling portion on the plan.

4. Field Test Reports: Monitoring Results: Submit monitoring results to the Contracting Officer within 3 working days, signed by the testing laboratory employee performing the air monitoring, the employee that analyzed the sample, and the CIH.
5. Records:
  - a. Completed and signed hazardous waste manifest from treatment or disposal facility.
  - b. Certification of Medical Examinations.
  - c. Employee training certification.

## **PART 2 PRODUCTS**

PAINT REMOVAL PRODUCTS: Submit applicable Material Safety Data Sheets for paint removal products used in paint removal work. Use the least toxic product, suitable for the job and acceptable to the Industrial Hygienist.

## **PART 3 EXECUTION**

### **3.1 PROTECTION**

- A. Notification: Notify the Contracting Officer twenty (20) days prior to the start of any paint removal work.
- B. Lead Control Area Requirements.
  1. Establish a lead control area by completely enclosing with containment screens the area or structure where lead-containing paint removal operations will be performed.
  2. Contain removal operations by the use of a negative pressure full containment system with at least one change room and with HEPA filtered exhaust.
- C. Protection of Existing Work to Remain: Perform paint removal work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition.
- D. Boundary Requirements: Provide physical boundaries around the lead control area by roping off the area [designated on the drawings] or providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.

- E. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6-mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area.
- F. Change Room and Shower Facilities: Provide clean change rooms and shower facilities within the physical boundary around the designated lead control area in accordance with requirements of 29 CFR 1926.62.
- G. Mechanical Ventilation System:
  - 1. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.57.
  - 2. To the extent feasible, use fixed local exhaust ventilation connected to HEPA filters or other collection systems, approved by the industrial hygienist. Local exhaust ventilation systems shall be designed, constructed, installed, and maintained in accordance with ANSI Z9.2.
  - 3. If air from exhaust ventilation is recirculated into the work place, the system shall have a high efficiency filter with reliable back-up filter and controls to monitor the concentration of lead in the return air and to bypass the recirculation system automatically if it fails. Air may be recirculated only where exhaust to the outside is not feasible.
- H. Personnel Protection: Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been given appropriate training and protective equipment.
- I. Warning Signs: Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.



### **3.2 WORK PROCEDURES**

- A. Perform removal of lead-containing paint in accordance with approved lead-containing paint removal plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when lead-containing paint is removed in accordance with 29 CFR 1926.62, except as specified herein. Dispose of removed paint chips and associated waste in compliance with Environmental Protection Agency (EPA), federal, state, and local requirements.
- B. Personnel Exiting Procedures:
  - 1. Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:
    - a. Vacuum themselves off.
    - b. Remove protective clothing in the decontamination room, and place them in an approved impermeable disposal bag.
    - c. Shower.
    - d. Change to clean clothes prior to leaving the physical boundary designated around the lead-contaminated job site.
- C. Monitoring: Monitoring of airborne concentrations of lead shall be in accordance with 29 CFR 1910.1025 and as specified herein. Air monitoring, testing, and reporting shall be performed by a CIH or an Industrial Hygiene (IH) Technician who is under the direction of the CIH:
  - 1. The CIH or the IH Technician under the direction of the CIH shall be on the job site directing the monitoring, and inspecting the lead-containing paint removal work to ensure that the requirements of the Contract have been satisfied during the entire lead-containing paint removal operation.
  - 2. Take personal air monitoring samples on employees who are anticipated to have the greatest risk of exposure as determined by the CIH. In addition, take air monitoring samples on at least 25 percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.

3. Submit results of air monitoring samples, signed by the CIH, within sixteen (16) hours after the air samples are taken. Notify the Contracting Officer immediately of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area.

D. Monitoring During Paint Removal Work:

1. Perform personal and area monitoring during the entire paint removal operation. Sufficient area monitoring shall be conducted at the physical boundary to ensure unprotected personnel are not exposed above 30 micrograms per cubic meter of air at all times. If the outside boundary lead levels are at or exceed 30 micrograms per cubic meter of air, work shall be stopped and the CIH shall immediately correct the condition(s) causing the increased levels and notify the Contracting Officer immediately.
2. The CIH shall review the sampling data collected on that day to determine if condition(s) requires any further change in work methods. Removal work shall resume when approval is given by the CIH. The Contractor shall control the lead level outside of the work boundary to less than 30 micrograms per cubic meter of air at all times. As a minimum, conduct area monitoring daily on each shift in which lead paint removal operations are performed in areas immediately adjacent to the lead control area.
3. For outdoor operations, at least one sample on each shift shall be taken on the downwind side of the lead control area. If adjacent areas are contaminated, clean and visually inspect contaminated areas. The CIH shall certify that the area has been cleaned of lead contamination.

**3.3 LEAD-CONTAINING PAINT REMOVAL**

- A. Remove paint within the areas designated on the drawings in order to completely expose the substrate. Take whatever precautions are necessary to minimize damage to the underlying substrate.
- B. Indoor Lead Paint Removal: Select paint removal processes to minimize contamination of work areas with lead-contaminated dust or other lead-contaminated debris/waste. This paint removal process should be described in the lead-containing paint removal plan. Perform manual sanding and scraping to the maximum extent feasible.

- C. Mechanical Paint Removal and Blast Cleaning: Perform mechanical paint removal and blast cleaning in lead control areas using negative pressure full containments with HEPA filtered exhaust. Collect paint residue and spent grit (used abrasive) from blasting operations for disposal in accordance with EPA, state and local requirements.
- D. Outside Lead Paint Removal: Select removal processes to minimize contamination of work areas with lead-contaminated dust or other lead-contaminated debris/waste. This paint removal process should be described in the lead-containing paint removal plan. Perform manual sanding and scraping to the maximum extent feasible.

### **3.4 SURFACE PREPARATIONS**

- A. Avoid flash rusting or other deterioration of the substrate. Provide surface preparations for painting in accordance with Section 09 91 00, PAINTING.

### **3.5 CLEANUP AND DISPOSAL**

- A. Cleanup: Maintain surfaces of the lead control area free of accumulations of paint chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the paint removal operation has been completed, clean the area of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner and wet mopping the area.
- B. Certification: The CIH shall certify in writing that the inside and outside the lead control area air monitoring samples are less than 30 micrograms per cubic meter of air, the respiratory protection for the employees was adequate, the work procedures were performed in accordance with 29 CFR 1926.62, and that there were no visible accumulations of lead-contaminated paint and dust on the worksite. Do not remove the lead control area or roped-off boundary and warning signs prior to the Contracting Officer's receipt of the CIH's certification. Re-clean areas showing dust or residual paint chips.
- C. Testing of Lead-Containing Paint Residue and Used Abrasive Where indicated or when directed by the Contracting Officer, test lead containing paint residue and used abrasive in accordance with 40 CFR 261 for hazardous waste.

D. Disposal:

1. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing, which may produce airborne concentrations of lead particles.
2. Store removed paint, lead-contaminated clothing and equipment, and lead-contaminated dust and cleaning debris into U.S. Department of Transportation (49 CFR 178) approved 55-gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date lead-contaminated wastes were first put into the drum. Obtain and complete the Uniform Hazardous Waste Manifest forms from the VA Activity Staff Civil Engineer. Comply with land disposal restriction notification requirements as required by 40 CFR 268:
  - a. At least 14 days prior to delivery, notify the Contracting Officer who will arrange for job site inspection of the drums and manifests by PWC Hazardous Waste Storage Facility personnel.
  - b. As necessary, make lot deliveries of hazardous wastes to the PWC Hazardous Waste Storage Facility to ensure that drums do not remain on the jobsite longer than 90 calendar days from the date affixed to each drum.
  - c. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing which may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62. Dispose of lead-contaminated waste material at a EPA or state-approved hazardous waste treatment, storage, or disposal facility off Government property.
  - d. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55-gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. The Contracting Officer or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
  - e. Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.

E. Disposal Documentation Submit written evidence that the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA and state or local regulatory agencies. Submit one copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262.

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**SECTION 05 50 00**  
**METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
  - 1. Support for Wall and Ceiling Mounted Items.

**1.2 RELATED WORK**

- A. Prime and finish painting: Section 09 91 00, PAINTING.
- B. Stainless steel corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Manufacturer's Literature and Data.
- C. Shop Drawings:
  - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
  - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
  - 3. Provide templates and rough-in measurements as required.
- D. Manufacturer's Certificates:
  - 1. Anodized finish as specified.
  - 2. Live load designs as specified.
- E. Design Calculations for specified live loads including dead loads.
- F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

#### 1.4 QUALITY ASSURANCE

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.
- C. Assembled product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

#### 1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
  - B18.6.1-97.....Wood Screws
  - B18.2.2-87(R2005).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
  - A36/A36M-08.....Structural Steel
  - A47-99(R2009).....Malleable Iron Castings
  - A48-03(R2008).....Gray Iron Castings
  - A53-10.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated  
Welded and Seamless
  - A123-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and  
Steel Products
  - A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel  
Steel Plate, Sheet and Strip
  - A269-10.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service
  - A307-10.....Carbon Steel Bolts and Studs, 60,000 PSI  
Tensile Strength
  - A312/A312M-09.....Seamless, Welded, and Heavily Cold Worked  
Austenitic Stainless Steel Pipes
  - A391/A391M-07.....Grade 80 Alloy Steel Chain



- A653/A653M-10.....Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
- A786/A786M-09.....Rolled Steel Floor Plate
- B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- B456-03(R2009).....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- B632-08.....Aluminum-Alloy Rolled Tread Plate
- C1107-08.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- D3656-07.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
- F436-10.....Hardened Steel Washers
- F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
- F593-02(R2008).....Stainless Steel Bolts, Hex Cap Screws, and Studs
- F1667-11.....Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
- D1.1-10.....Structural Welding Code Steel
- D1.2-08.....Structural Welding Code Aluminum
- D1.3-08.....Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
- AMP 521-01.....Pipe Railing Manual
- AMP 500-06.....Metal Finishes Manual
- MBG 531-09.....Metal Bar Grating Manual
- MBG 532-09.....Heavy Duty Metal Bar Grating Manual
- F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:
- SP 1-04.....No. 1, Solvent Cleaning
- SP 2-04.....No. 2, Hand Tool Cleaning
- SP 3-04.....No. 3, Power Tool Cleaning
- G. Federal Specifications (Fed. Spec):
- RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A167, Type 302 or 304.
- C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- D. Steel Pipe: ASTM A53.
  - 1. Galvanized for exterior locations.
  - 2. Type S, Grade A unless specified otherwise.
  - 3. NPS (inside diameter) as shown.
- E. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- F. Malleable Iron Castings: A47.
- G. Primer Paint: As specified in Section 09 91 00, PAINTING.
- H. Stainless Steel Tubing: ASTM A269, type 302 or 304.
- I. Modular Channel Units:
  - 1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
  - 2. Form channel with in-turned pyramid shaped clamping ridges on each side.
  - 3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
  - 4. Factory-finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
  - 5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.
- J. Grout: ASTM C1107, pourable type.

## **2.2 HARDWARE**

### **A. Rough Hardware:**

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

### **B. Fasteners:**

1. Bolts with Nuts:
  - a. ASME B18.2.2.
  - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
  - c. ASTM F468 for nonferrous bolts.
  - d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

## **2.3 FABRICATION, GENERAL**

### **A. Material**

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

### **B. Size:**

1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

### **C. Connections**

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.

4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self-drilling and tapping screws or bolts.

E. Workmanship

1. General:
  - a. Fabricate items to design shown.
  - b. Furnish members in longest lengths commercially available within the limits shown and specified.
  - c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
  - d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.

- e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
  - f. Prepare members for the installation and fitting of hardware.
  - g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
  - h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
- a. Weld in accordance with AWS.
  - b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
  - c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
  - d. Finish welded joints to match finish of adjacent surface.
3. Joining:
- a. Miter or butt members at corners.
  - b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
  - b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
- a. Accurately cut, machine and fit joints, corners, copes, and miters.
  - b. Fit removable members to be easily removed.
  - c. Design and construct field connections in the most practical place for appearance and ease of installation.
  - d. Fit pieces together as required.

- e. Fabricate connections for ease of assembly and disassembly without use of special tools.
  - f. Joints firm when assembled.
  - g. Conceal joining, fitting and welding on exposed work as far as practical.
  - h. Do not show rivets and screws prominently on the exposed face.
  - i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.
- F. Finish:
- 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
  - 2. Aluminum: NAAMM AMP 501.
    - a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
    - b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
    - c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
    - d. Painted: AA-C22R10.
  - 3. Steel and Iron: NAAMM AMP 504.
    - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
    - b. Surfaces exposed in the finished work:
      - 1) Finish smooth rough surfaces and remove projections.
      - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
    - c. Shop Prime Painting:
      - 1) Surfaces of Ferrous metal:
        - a) Items not specified to have other coatings.
        - b) Galvanized surfaces specified to have prime paint.
        - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
        - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.

e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

2) Non-ferrous metals: Comply with MAAMM-500 series.

4. Stainless Steel: NAAMM AMP-504 Finish No. 4.

G. Protection:

1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

**2.4 SUPPORTS**

A. General:

1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections may be welded or bolted.

B. For Wall-Mounted Items:

1. For items supported by metal stud partitions.
2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
4. Steel hat channels where shown. Flange cut and flattened for anchorage to stud.
5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

C. Supports for Accordion Partition Tracks, Exercise Equipment, and Items at Various Conditions at Suspended Ceilings:

1. Fabricate of structural steel shapes as shown.
2. Drill for anchor bolts of suspended item.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION, GENERAL**

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
  - 1. Provide temporary bracing for such items until concrete or masonry is set.
  - 2. Place in accordance with setting drawings and instructions.
  - 3. Build strap anchors, into masonry as work progresses.
- C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
- D. Field-weld in accordance with AWS.
  - 1. Design and finish as specified for shop welding.
  - 2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.
- F. Spot-prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.
- H. Secure escutcheon plate with set screw.

#### **3.2 INSTALLATION OF SUPPORTS**

- A. Anchorage to structure.
  - 1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
  - 2. Secure supports to concrete inserts by bolting or continuous welding as shown.
  - 3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
  - 4. Secure steel plate or hat channels to studs as detailed.



C. Supports for Wall-Mounted items:

1. Locate center of support at anchorage point of supported item.
2. Locate support at top and bottom of wall hung cabinets.
3. Locate support at top of floor cabinets and shelving installed against walls.
4. Locate supports where required for items shown.

**3.3 DOOR FRAMES**

- A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.
- B. Level and plumb frame; brace in position required.
- C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.
- D. Set frames in formwork for frames cast into concrete.
- E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

**3.4 OTHER FRAMES**

- A. Set frame flush with surface, unless shown otherwise.
- B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.
- C. Set in formwork before concrete is placed.

**3.5 CLEAN AND ADJUSTING**

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

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**SECTION 06 10 00**  
**ROUGH CARPENTRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies wood blocking, framing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

**1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

**1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 150 mm (6 inches) above grade and cover with well-ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Forest and Paper Association (AFPA):  
National Design Specification for Wood Construction  
NDS-05.....Conventional Wood Frame Construction
- C. American Institute of Timber Construction (AITC):  
A190.1-07.....Structural Glued Laminated Timber
- D. American Society of Mechanical Engineers (ASME):  
B18.2.1-96(R2005).....Square and Hex Bolts and Screws  
B18.2.2-87.....Square and Hex Nuts  
B18.6.1-97.....Wood Screws  
B18.6.4-98(R2005).....Thread Forming and Thread Cutting Tapping  
Screws and Metallic Drive Screws

E. American Plywood Association (APA):

E30-07.....Engineered Wood Construction Guide

F. American Society for Testing And Materials (ASTM):

A47-99(R2009).....Ferritic Malleable Iron Castings

A48-03(R2008).....Gray Iron Castings

A653/A653M-10.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-  
Iron Alloy Coated (Galvannealed) by the Hot Dip  
Process

C954-10.....Steel Drill Screws for the Application of  
Gypsum Board or Metal Plaster Bases to Steel  
Studs from 0.033 inch (2.24 mm) to 0.112-inch  
(2.84 mm) in thickness

C1002-07.....Steel Self-Piercing Tapping Screws for the  
Application of Gypsum Panel Products or Metal  
Plaster Bases to Wood Studs or Metal Studs

D143-09.....Small Clear Specimens of Timber, Method of  
Testing

D1760-01.....Pressure Treatment of Timber Products

D2559-10.....Adhesives for Structural Laminated Wood  
Products for Use Under Exterior (Wet Use)  
Exposure Conditions

D3498-11.....Adhesives for Field-Gluing Plywood to Lumber  
Framing for Floor Systems

F844-07.....Washers, Steel, Plain (Flat) Unhardened for  
General Use

F1667-08.....Nails, Spikes, and Staples

G. Federal Specifications (Fed. Spec.):

MM-L-736C.....Lumber; Hardwood

H. Commercial Item Description (CID):

A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self  
Threading Anchors)

I. Military Specification (Mil. Spec.):

MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated

J. Truss Plate Institute (TPI):

TPI-85.....Metal Plate Connected Wood Trusses

- K. U.S. Department of Commerce Product Standard (PS)  
PS 1-95.....Construction and Industrial Plywood  
PS 20-05.....American Softwood Lumber Standard

## **PART 2 - PRODUCTS**

### **2.1 LUMBER**

- A. Unless otherwise specified, each piece of lumber bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
  2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Structural Members: Species and grade as listed in the AFPA, National Design Specification for Wood Construction having design stresses as shown.
- C. Lumber Other Than Structural:
1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
  2. Framing lumber: Minimum extreme fiber stress in bending of 1100.
  3. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.
- D. Sizes:
1. Conforming to Prod. Std., PS20.
  2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.
- E. Moisture Content:
1. At time of delivery and maintained at the site.
  2. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
  3. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire-Retardant Treatment:

1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 600 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members used in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with ASTM D1760, except any process involving the use of Chromated Copper arsenate (CCA) for pressure treating wood is not permitted.

**2.2 PLYWOOD**

A. Comply with Prod. Std., PS 1.

B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.

C. Subflooring:

1. Under finish wood flooring or underlayment:
  - a. APA Rated sheathing, Exposure 1. panel grade CD.
  - b. Minimum 15 mm (19/32 inch) thick with span rating 32/16 or greater for supports at 400 mm (16 inches) on center and 18.25 mm (23/32 inch) thick with span rating 48/24 for supports at 600 mm (24 inches) on center.
2. Combination subflooring-underlayment under resilient flooring or carpet:
  - a. APA Rated Stud-I-Floor Exterior or Exposure 1, T and G.
  - b. Minimum 15 mm (19/32 inch) thick or greater, span rating 16, for supports at 400 mm (16 inches) on center; 18 mm (23/32 inch) thick or greater, span rating 24, for supports at 600 mm (24 inches) on center.

D. Underlayment:

1. APA rated Exposure 1 or Exterior, panel grade C-C Plugged.
2. Minimum 6 mm (1/4 inch) thick or greater over plywood subflooring // and 9 mm (3/8 inch) thick or greater over board subflooring, // unless otherwise shown.

**2.3 ROUGH HARDWARE AND ADHESIVES**

A. Anchor Bolts:

1. ASME B18.2.1 and ANSI B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
2. Extend at least 200 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).

B. Miscellaneous Bolts: Expansion Bolts: C1D, A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Use 13 mm (1/2 inch) bolt unless shown otherwise.

C. Washers

1. ASTM F844.
2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.

D. Screws:

1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:

1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
2. ASTM F1667:
  - a. Common: Type I, Style 10.
  - b. Concrete: Type I, Style 11.
  - c. Barbed: Type I, Style 26.
  - d. Underlayment: Type I, Style 25.
  - e. Masonry: Type I, Style 27.
  - f. Use special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS**

- A. Conform to applicable requirements of the following:
  - 1. AFPA National Design Specification for Wood Construction for timber connectors.
  - 2. AITC Timber Construction Manual for heavy timber construction.
  - 3. AFPA WCD-number 1, Manual for House Framing for nailing and framing unless specified otherwise.
  - 4. APA for installation of plywood or structural use panels.
  - 5. ASTM F 499 for wood underlayment.
  - 6. TPI for metal plate connected wood trusses.
- B. Fasteners:
  - 1. Nails.
    - a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA Manual for House Framing where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
    - b. Use special nails with framing connectors.
    - c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.
    - d. Use eight penny or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
    - e. Use 16 penny or larger nails for nailing through 50 mm (2 inch) thick lumber.
    - f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
    - g. Nailing Schedule; Using Common Nails:
      - 1) Joist bearing on sill or girder, toe nail three-8d or framing anchor
      - 2) Bridging to joist, toe nail each end two-8d
      - 3) Ledger strip to beam or girder three-16d under each joint.
      - 4) Subflooring or Sheathing:
        - a) 150 mm (6 inch) wide or less to each joist face nail two-8d.



- b) Subflooring, more than 150 mm (6 inches) wide, to each stud or joint, face nail three-8d.
  - c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 150 mm (6 inches) on center and at intermediate supports 250 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 300 mm (12 inches) at supported edges and 500 mm (20 inches) o.c. at intermediate supports.
  - 5) Sole plate to joist or blocking, through sub floor face nail 20d nails, 400 mm (16 inches) on center.
  - 6) Top plate to stud, end nail two-16d.
  - 7) Stud to sole plate, toe nail or framing anchor. Four-8d
  - 8) Doubled studs, face nail 16d at 600 mm (24 inches) on center.
  - 9) Built-up corner studs 16d at 600 mm (24 inches) (24 inches) on center.
  - 10) Doubled top plates, face nails 16d at 400 mm (16 inches) on center.
  - 11) Top plates, laps, and intersections, face nail two-16d.
  - 12) Continuous header, two pieces 16d at 400 mm (16 inches) on center along each edge.
  - 13) Ceiling joists to plate, toenail three-8d or framing anchor.
  - 14) Continuous header to stud, four 16d.
  - 15) Ceiling joists, laps over partitions, face nail three-16d or framing anchor.
  - 16) Ceiling joists, to parallel rafters, face nail three-16d.
  - 17) Rafter to plate, toe nail three-8d. or framing anchor. Brace 25 mm (1 inch) thick board to each stud and plate, face nail three-8d.
  - 18) Built-up girders and beams 20d at 800 mm (32 inches) on center along each edge.
2. Bolts:
- a. Fit bolt heads and nuts bearing on wood with washers.
  - b. Countersink bolt heads flush with the surface of nailers.
  - c. Embed in concrete and solid masonry or use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
  - d. Use toggle bolts to hollow masonry or sheet metal.

- e. Use bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 600 mm (24 inch) intervals between end bolts. Use clips to beam flanges.
- 3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
  - a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
  - b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.
- 4. Power actuated drive pins may be used where practical to anchor to solid masonry, concrete, or steel.
- 5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Use metal plugs, inserts or similar fastening.
- 6. Screws to Join Wood:
  - a. Where shown or option to nails.
  - b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
  - c. Spaced same as nails.
- 7. Installation of Timber Connectors:
  - a. Conform to applicable requirements of the NFPA National Design Specification for Wood Construction.
  - b. Fit wood to connectors and drill holes for fasteners so wood is not split.
- C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
  - 1. Space anchor bolts 1200 mm (4 feet) on centers between ends and within 150 mm (6 inches) of end. Stagger bolts from side to side on plates over 175 mm (7 inches) in width.
  - 2. Use shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
  - 3. Closely fit, and set to required lines.
- D. Cut notch, or bore in accordance with NFPA Manual for House-Framing for passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.

E. Blocking Nailers and Furring:

1. Install furring, blocking, nailers, and grounds where shown.
2. Use longest lengths practicable.
3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.
4. Layers of Blocking or Plates:
  - a. Stagger end joints between upper and lower pieces.
  - b. Nail at ends and not over 600 mm (24 inches) between ends.
  - c. Stagger nails from side to side of wood member over 125 mm (5 inches) in width.
5. Unless otherwise shown, use wall furring 25 mm by 75 mm (1 inch by 3 inch) continuous wood strips installed plumb on walls, using wood shims where necessary so face of furring forms a true, even plane. Space furring not over 400 mm (16 inches on centers, butt joints over bearings and rigidly secure in place. Anchor furring on 400 mm (16 inches) centers.

F. Partition and Wall Framing:

1. Use 50 mm by 100 mm (2 inch by 4 inch) studs spaced 400 mm (16 inches) on centers; unless shown otherwise.
2. Install double studs at openings and triple studs at corners.
3. Installation of sole plate:
  - a. Anchor plates of walls or partitions resting on concrete floors in place with expansion bolts, one near ends of piece and at intermediate intervals of not more than 1200 mm (4 feet) or with power actuated drive pins with threaded ends of suitable type and size, spaced 600 mm (2 feet) on center unless shown otherwise.
  - b. Nail plates to wood framing through subfloor as specified in nailing schedule.
4. Headers or Lintels:
  - a. Make headers for openings of two pieces of 50 mm (2 inch) thick lumber of size shown with plywood filler to finish flush with face of studs or solid lumber of equivalent size.
  - b. Support ends of headers on top of stud cut for height of opening. Spike cut stud to adjacent stud. Spike adjacent stud to header.
5. Use double top plates, with members lapped at least 610 mm (2-feet) spiked together.

6. Install intermediate cut studs over headers and under sills to maintain uniformity of stud spacing.
7. Use single sill plates at bottom of opening unless shown otherwise. Toe nail to end stud, face nail to intermediate studs.
8. Install 50 mm (2 inch) blocking for firestopping so that maximum dimension of any concealed space is not over 2400mm (8 feet) in accordance with NFPA Manual for House Framing.
9. Install corner bracing when plywood or structured use panel sheathing is not used.
  - a. Let corner bracing into exterior surfaces of studs at an angle of approximately 45 degrees, extended completely over walls plates, and secured at bearing with two nails.
  - b. Use 25 mm by 100 mm (1 inch by 4 inch) corner bracing.

G. Underlayment:

1. Where finish flooring of different thickness is used in adjoining areas, use underlayment of thickness required to bring finish flooring surfaces into same plane.
2. Apply to dry, level, securely nailed, clean, wood subfloor without any projections.
3. Fasten to subfloor as specified in ASTM F499.
4. Plywood and particle underlayment may be glue-nailed to subfloor.
5. Butt underlayment panels to a light contact with a 1 mm (1/32 inch) space between plywood or hardboard underlayment panels and walls, and approximately 9 mm (3/8 inch) between particleboard underlayment panels and walls.
6. Stagger underlayment panel end joints with respect to each other and offset joints with respect to joints in the subfloor at least 50 mm (2 inches).
7. After installation, avoid traffic on underlayment and damage to its finish surface.

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**SECTION 07 08 00**

**FACILITY EXTERIOR CLOSURE COMMISSIONING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 07 and Division 08.
- 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 commissioning 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 07 and Division 08 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 07 and 08, 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 the building envelope systems will require inspection of individual elements of the envelope 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 envelope 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 CONTRACTOR'S TESTS**

- A. Contractor tests as required by other sections of Division 07 or Division 08 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 07 and 08 Sections for additional Contractor training requirements.

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**SECTION 07 84 00**  
**FIRESTOPPING**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.
- B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

**1.2 RELATED WORK**

- A. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- B. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Manufacturer's literature, data, and installation instructions for types of firestopping and smoke stopping used.
- C. List of FM, UL, or WH classification number of systems installed.
- D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

**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 WARRANTY**

- A. Firestopping work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

**1.6 QUALITY ASSURANCE**

- A. FM, UL, or WH or other approved laboratory tested products will be acceptable.

## **1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - E84-10.....Surface Burning Characteristics of Building Materials
  - E814-11.....Fire Tests of Through-Penetration Fire Stops
- C. Factory Mutual Engineering and Research Corporation (FM):
  - Annual Issue Approval Guide Building Materials
- D. Underwriters Laboratories, Inc. (UL):
  - Annual Issue Building Materials Directory
  - Annual Issue Fire Resistance Directory
  - 1479-10.....Fire Tests of Through-Penetration Firestops
- E. Warnock Hersey (WH):
  - Annual Issue Certification Listings

## **PART 2 - PRODUCTS**

### **2.1 FIRESTOP SYSTEMS**

- A. Use 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.
- 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 100 mm (4 in) nominal pipe or 0.01 m<sup>2</sup> (16 sq. in.) in overall cross sectional area.
- C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.

- D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
1. Contain no flammable or toxic solvents.
  2. Have 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 used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
- E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall 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.
  3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
- F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
- G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. Materials to be asbestos free.

## **2.2 SMOKE STOPPING IN SMOKE PARTITIONS**

- A. Use silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.
- B. Use mineral fiber filler and bond breaker behind sealant.
- C. Sealants shall have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with 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.

**3.2 PREPARATION**

- A. Remove dirt, grease, oil, 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 (six inches) on either 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.

**3.3 INSTALLATION**

- A. Do not begin 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 AND ACCEPTANCE OF WORK**

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the Resident Engineer.
- C. Clean up spills of liquid type materials.

- - - E N D - - -

**SECTION 07 92 00**  
**JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

**1.2 RELATED WORK**

- A. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.
- B. Mechanical Work: Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION / Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

**1.3 QUALITY CONTROL**

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
  - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
  - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
  - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

- D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations:
1. Locate test joints where indicated or, if not indicated, as directed by Resident Engineer.
  2. Conduct field tests for each application indicated below:
    - a. Each type of elastomeric sealant and joint substrate indicated.
    - b. Each type of non-elastomeric sealant and joint substrate indicated.
  3. Notify Resident Engineer seven days in advance of dates and times when test joints will be erected.
  4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
- E. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Cured samples of exposed sealants for each color where required to match adjacent material.
- D. Manufacturer's Literature and Data:
  1. Caulking compound
  2. Primers
  3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

#### **1.5 PROJECT CONDITIONS**

- A. Environmental Limitations:
1. Do not proceed with installation of joint sealants under following conditions:
    - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
    - b. When joint substrates are wet.

B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

**1.6 DELIVERY, HANDLING AND STORAGE**

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 32° C (90° F) or less than 5° C (40° F).

**1.7 DEFINITIONS**

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

**1.8 WARRANTY**

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.
- B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

**1.9 APPLICABLE PUBLICATIONS**

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

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

- C509-06.....Elastomeric Cellular Preformed Gasket and  
Sealing Material.
- C612-10.....Mineral Fiber Block and Board Thermal  
Insulation.
- C717-10.....Standard Terminology of Building Seals and  
Sealants.
- C834-10.....Latex Sealants.
- C919-08.....Use of Sealants in Acoustical Applications.
- C920-10.....Elastomeric Joint Sealants.
- C1021-08.....Laboratories Engaged in Testing of Building  
Sealants.
- C1193-09.....Standard Guide for Use of Joint Sealants.
- C1330-02 (R2007).....Cylindrical Sealant Backing for Use with Cold  
Liquid Applied Sealants.
- D1056-07.....Specification for Flexible Cellular Materials—  
Sponge or Expanded Rubber.
- E84-09.....Surface Burning Characteristics of Building  
Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).  
The Professionals' Guide

**PART 2 - PRODUCTS**

**2.1 SEALANTS**

A. S-1:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 20-40

B. S-2:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade P.
5. Shore A hardness of 25-40.



C. S-3:

1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-25.
6. Minimum elongation of 700 percent.

D. S-4:

1. ASTM C920 polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-40.

E. S-5:

1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade P.
5. Shore hardness of 15-45.

F. S-6:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.
6. Minimum elongation of 1200 percent.

G. S-7:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

H. S-8:

1. ASTM C920, silicone, acetoxy cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

I. S-9:

1. ASTM C920 silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Non-yellowing, mildew resistant.

J. S-10:

1. ASTM C920, coal tar extended fuel resistance polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 15-20.

K. S-11:

1. ASTM C920 polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 35 to 50.

L. S-12:

1. ASTM C920, polyurethane.
2. Type M/S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade P/NS.
5. Shore A hardness of 25 to 50.

**2.2 CAULKING COMPOUND**

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

### **2.3 COLOR**

- A. Sealants used with exposed masonry shall match color of mortar joints.
- B. Sealants used with unpainted concrete shall match color of adjacent concrete.
- C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.
- D. Caulking shall be light gray or white, unless specified otherwise.

### **2.4 JOINT SEALANT BACKING**

- A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
  - 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

### **2.5 FILLER**

- A. Mineral fiber board: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

### **2.6 PRIMER**

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

## **2.7 CLEANERS-NON POUROUS SURFACES**

- A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing materials, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

### **3.2 PREPARATIONS**

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
  - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
  - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.

- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
  - 1. Apply primer prior to installation of back-up rod or bond breaker tape.
  - 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

### **3.3 BACKING INSTALLATION**

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

### **3.4 SEALANT DEPTHS AND GEOMETRY**

- A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

### 3.5 INSTALLATION

#### A. General:

1. Apply sealants and caulking only when ambient temperature is between 5° C and 38° C (40° and 100° F).
2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool joints to concave surface unless shown or specified otherwise.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.

#### B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

#### C. Where gypsum board partitions are of sound-rated, fire-rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.

1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.

5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

### **3.6 FIELD QUALITY CONTROL**

- A. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- B. Inspect tested joints and report on following:
  1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
  2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
  3. Whether sealants filled joint cavities and are free from voids.
  4. Whether sealant dimensions and configurations comply with specified requirements.
- C. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
- D. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- E. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### **3.7 CLEANING**

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

### 3.8 LOCATIONS

A. Exterior Building Joints, Horizontal and Vertical:

1. Metal to Metal: Type S-1, S-2
2. Metal to Masonry or Stone: Type S-1
3. Masonry to Masonry or Stone: Type S-1
4. Stone to Stone: Type S-1
5. Cast Stone to Cast Stone: Type S-1
6. Threshold Setting Bed: Type S-1, S-3, S-4
7. Masonry Expansion and Control Joints: Type S-6
8. Wood to Masonry: Type S-1

B. Metal Reglets and Flashings:

1. Flashings to Wall: Type S-6
2. Metal to Metal: Type S-6

C. Sanitary Joints:

1. Walls to Plumbing Fixtures: Type S-9
2. Counter Tops to Walls: Type S-9
3. Pipe Penetrations: Type S-9

D. High Temperature Joints over 204 degrees C (400 degrees F):

1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8

E. Interior Caulking:

1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1 and C-2.
2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1 and C-2.
3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1 and C-2.
4. Perimeter of Lead-Faced Control Windows and Plaster or Gypsum Wallboard Walls: Types C-1 and C-2.
5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1 and C-2.
6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.
7. Concealed Acoustic Sealant Types S-4, C-1 and C-2.

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**SECTION 08 11 13  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel doors, steel frames and related components.
- B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.

**1.2 RELATED WORK**

- A. Door Hardware: Section 08 71 00, DOOR HARDWARE.
- B. Glazing and ballistic rated glazing: Section 08 80 00, GLAZING.
- C. Card readers and biometric devices: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS.

**1.3 TESTING**

- A. An independent testing laboratory shall perform testing.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Manufacturers Literature and Data:
  - 1. Fire-rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements.

**1.5 SHIPMENT**

- A. Prior to shipment, label each door and frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame.

**1.6 STORAGE AND HANDLING**

- A. Store doors and frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

## 1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):  
L-S-125B.....Screening, Insect, Nonmetallic
- C. Door and Hardware Institute (DHI):  
A115 Series.....Steel Door and Frame Preparation for Hardware,  
Series A115.1 through A115.17 (Dates Vary)
- D. Steel Door Institute (SDI):  
113-01 (R2006).....Thermal Transmittance of Steel Door and Frame  
Assemblies  
128-09.....Acoustical Performance for Steel Door and Frame  
Assemblies
- E. American National Standard Institute:  
A250.8-2003 (R2008).....Specifications for Standard Steel Doors and  
Frames
- F. American Society for Testing and Materials (ASTM):  
A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel  
Steel Plate, Sheet, and Strip  
A568/568-M-11.....Steel, Sheet, Carbon, and High-Strength, Low-  
alloy, Hot-Rolled and Cold-Rolled  
A1008-10.....Steel, sheet, Cold-Rolled, Carbon, Structural,  
High Strength Low Alloy and High Strength Low  
Alloy with Improved Formability  
B209/209M-10.....Aluminum and Aluminum-Alloy Sheet and Plate  
B221/221M-12.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Profiles and Tubes  
D1621-10.....Compressive Properties of Rigid Cellular  
Plastics  
D3656-07.....Insect Screening and Louver Cloth Woven from  
Vinyl Coated Glass Yarns  
E90-09.....Laboratory Measurement of Airborne Sound  
Transmission Loss of Building Partitions
- G. The National Association Architectural Metal Manufacturers (NAAMM):  
Metal Finishes Manual (AMP 500-06)

- H. National Fire Protection Association (NFPA):  
80-13.....Fire Doors and Fire Windows
- I. Underwriters Laboratories, Inc. (UL):  
Fire Resistance Directory
- J. Intertek Testing Services (ITS):  
Certifications Listings...Latest Edition
- K. Factory Mutual System (FM):  
Approval Guide

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Stainless Steel: ASTM A167, Type 302 or 304; finish, NAAMM Number 4.
- B. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- C. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- D. Aluminum Sheet: ASTM B209/209M.
- E. Aluminum, Extruded: ASTM B221/221M.
- F. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

### **2.2 FABRICATION GENERAL**

- A. GENERAL:
  - 1. Follow ANSI A250.8 for fabrication of standard steel doors, except as specified otherwise. Doors to receive hardware specified in Section 08 71 00, DOOR HARDWARE. Tolerances as per ANSI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
  - 2. Close top edge of doors flush and seal to prevent water intrusion.
  - 3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.
- B. Standard-Duty Doors: ANSI A250.8, Level 1, Full flush seamless design of size and design shown. Use for interior locations only. Do not use for stairwell doors, security doors and detention doors.
- C. Heavy-Duty Doors: ANSI A250.8, Level 2, Full flush seamless design of size and design shown. Core construction types a, d, or f, for interior doors, and, types b, c, e, or f, for exterior doors.

- D. Extra Heavy Duty Doors: ANSI A250.8, Level 3, Full flush seamless design of size and design shown. Core construction Types d or f, for interior doors, and Types b, c, e, or f, for exterior doors. Use for detention doors, stairwell doors and security doors. See additional requirements for detention doors, under paragraph "Custom Hollow Metal Doors.

Core Construction Type	Door Core Description
a	Kraft honeycomb
b	Polyurethane
c	Polystyrene
d	Unitized steel grid
e	Mineral fiberboard
f	Vertical steel stiffeners

E. Smoke Doors:

1. Close top and vertical edges flush.
2. Provide seamless vertical edges.
3. Apply Steel astragal to the meeting stile at the active leaf of pair of doors or double egress doors.
4. Provide clearance at head, jamb and sill as specified in NFPA 80.

F. Fire-Rated Doors (Labeled):

1. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual for the class of door or door opening shown.
2. Fire-rated labels of metal, with raised or incised markings of approving laboratory shall be permanently attached to doors.
3. Close top and vertical edges of doors flush. Vertical edges shall be seamless. Apply steel astragal to the meeting stile of the active leaf of pairs of fire rated doors, except where vertical rod exit devices are specified for both leaves swinging in the same direction.

4. Construct fire rated doors in stairwell enclosures for maximum transmitted temperature rise of 230 °C (450 °F) above ambient temperature at end of 30 minutes of fire exposure when tested in accordance with ASTM E152.

G. Custom Metal Hollow Doors:

1. Provide custom hollow metal doors where nonstandard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Door size(s), design, materials, construction, gages and finish shall be as specified for of standard steel doors.

## **2.3 METAL FRAMES**

A. General:

1. ANSI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
2. Frames for labeled fire-rated doors.
  - a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual.
  - b. Fire-rated labels of approving laboratory permanently attached to frames as evidence of conformance with these requirements.  
Provide labels of metal or engraved stamp, with raised or incised markings.
3. Knocked-down frames are not acceptable.

B. Reinforcement and Covers:

1. ANSI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. Provide mortar guards securely fastened to back of hardware reinforcements.
3. Where concealed door closers are installed within the head of the door frames, prepare frames for closers and provide 1 mm (0.042 inch) thick steel removable stop sections for access to concealed face plates and control valves, except when cover plates are furnished with closer.

C. Terminated Stops: ANSI A250.8.

D. Glazed Openings:

- a. Integral stop on exterior, corridor, or secure side of door.
- b. Design rabbet width and depth to receive glazing material or panel shown or specified.

E. Frame Anchors:

1. Floor anchors:

- a. Where floor fills occur, provide extension type floor anchors to compensate for depth of fill.
- b. At bottom of jamb use 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive two 6 mm (1/4 inch) floor bolts. Use 50 mm x 50 mm (2 inch by 2 inch) 9 mm by (3/8 inch) clip angle for lead lined frames, drilled for 9 mm (3/8 inch) floor bolts.
- c. Where mullions occur, provide 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two 6 mm (1/4 inch) floor bolts and frame anchor screws.
- d. Where sill sections occur, provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for 6 mm (1/4 inch) floor bolts and frame anchor screws. Space floor bolts at 50 mm (24 inches) on center.

2. Jamb anchors:

- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire-rated frames space anchors as required by labeling authority.
- b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
- c. Anchors set in masonry: Use adjustable anchors designed for friction fit against the frame and for extension into the masonry not less than 250 mm (10 inches). Use one of following type:
  - 1) Wire loop type of 5 mm (3/16 inch) diameter wire.
  - 2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.
- d. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.

- e. Anchors for frames set in prepared openings:
  - 1) Steel pipe spacers with 6 mm (1/4 inch) inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 50 mm (2 inches) wide, welded to jamb near stop.
  - 2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.
- f. Anchors for observation windows and other continuous frames set in stud partitions:
  - 1) In addition to jamb anchors, weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
  - 2) Anchors spaced 600 mm (24 inches) on centers maximum.
- g. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.

## **2.6 SHOP PAINTING**

- A. ANSI A250.8.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Plumb, align and brace frames securely until permanent anchors are set.
  - 1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
  - 2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
  - 3. Protect frame from accidental abuse.
  - 4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
  - 5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.
- B. Floor Anchors:
  - 1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
  - 2. Power-actuated drive pins may be used to secure frame anchors to concrete floors.

C. Jamb Anchors:

1. Anchors in masonry walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
2. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls.
3. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.
4. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 6 mm (1/4 inch) expansion bolts through spacers. Where subframes or rough bucks are used, 6 mm (1/4 inch) expansion bolts on 600 mm (24 inch) centers or power activated drive pins 600 mm (24 inches) on centers. Secure two piece frames to subframe or rough buck with machine screws on both faces.

- D. Install anchors for labeled fire-rated doors to provide rating as required.

**3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE**

- A. Install doors and hardware as specified in Sections Section 08 11 13, HOLLOW METAL DOORS AND FRAMES and Section 08 71 00, DOOR HARDWARE.

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**SECTION 08 31 13**  
**ACCESS DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies access doors or panels.

**1.2 RELATED WORK**

- A. Access doors in acoustical ceilings: Section 09 51 00, ACOUSTICAL  
CEILINGS.
- B. Locations of access doors for duct work cleanouts: Section 23 31 00,  
HVAC DUCTS AND CASINGS.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA  
and SAMPLES.
- B. Shop Drawings: Access doors, each type, showing construction, location  
and installation details.
- C. Manufacturer's Literature and Data: Access doors, each type.

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent  
referenced. Publications are referenced in the text by basic  
designation only.
- B. American Society for Testing and Materials (ASTM):
- A167-99(R-2009).....Stainless and Heat-Resisting Chromium-Nickel  
Steel Plate, Sheet and Strip
- A1008-10.....Steel Sheet, Cold-Rolled, Carbon, Structural,  
High Strength Low-Alloy
- C. American Welding Society (AWS):
- D1.3-08.....Structural Welding Code Sheet Steel
- D. National Fire Protection Association (NFPA):
- 80-10.....Fire Doors and Windows
- E. The National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500 Series.....Metal Finishes Manual
- F. Underwriters Laboratories, Inc. (UL):
- Fire Resistance Directory

## **PART 2 - PRODUCTS**

### **2.1 FABRICATION, GENERAL**

- A. Fabricate components to be straight, square, flat and in same plane where required.
  - 1. Slightly round exposed edges and without burrs, snags and sharp edges.
  - 2. Exposed welds continuous and ground smooth.
  - 3. Weld in accordance with AWS D1.3.
- B. Number of locks and non-continuous hinges as required to maintain alignment of panel with frame. For fire-rated doors, use hinges and locks as required by fire test.
- C. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors on four sides to secure access door in opening. Provide anchors as required by fire test.

### **2.2 ACCESS DOORS, FIRE-RATED**

- A. Shall meet requirements for "B" label 1-1/2 hours with maximum temperature rise of 120 degree C (250 degrees F).
- B. Comply with NFPA 80 and have Underwriters Laboratories Inc., or other nationally recognized laboratory label for Class B opening.
- C. Door Panel: Form of 0.9 mm (0.0359 inch) thick steel sheet, insulated sandwich type construction.
- D. Frame: Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed. Provide frame flange at perimeter where installed in concrete masonry or gypsum board openings.
  - 1. Weld exposed joints in flange and grind smooth.
  - 2. Provide frame flange at perimeter where installed in concrete masonry or gypsum board.
  - 3. Provide expanded galvanized metal lath perimeter wings when installed in plaster except veneer plaster.
- E. Automatic Closing Device: Provide automatic closing device for door.
- F. Hinge: Continuous steel hinge with stainless steel pin.

G. Lock:

1. Self-latching, with provision for fitting flush a standard screw-in type lock cylinder.
2. Provide latch release device operable from inside of door. Mortise case in door.

**2.3 ACCESS DOORS, FLUSH PANEL**

A. Door Panel:

1. Form of 1.9 mm (0.0747 inch) thick steel sheet.
2. Reinforce to maintain flat surface.

B. Frame:

1. Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed.
2. Provide surface-mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
3. Weld exposed joints in flange and grind smooth.
4. Provide expanded galvanized metal lath perimeter wings when installed in plaster except veneer plaster.

C. Hinge:

1. Concealed spring hinge to allow panel to open 175 degrees.
2. Provide removable hinge pin to allow removal of panel from frame.

D. Lock:

1. Flush, screwdriver operated cam lock.
2. Provide tamper proof screws (spanner head locks) for access panels in Psychiatric Areas.

**2.4 FINISH**

- A. Provide in accordance with NAAMM AMP 500 series on exposed surfaces.
- B. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.

**2.6 SIZE**

- A. Minimum 600 mm (24 inches) square door, unless otherwise shown or required to suit opening in suspension system of ceiling.

### **PART 3 - EXECUTION**

#### **3.1 LOCATION**

- A. Provide access panels or doors wherever any valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.
- B. Use fire-rated doors in fire rated partitions and ceilings.
- C. Use flush panels in partitions and gypsum board or plaster ceilings, except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

#### **3.2 INSTALLATION, GENERAL**

- A. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling suspension grid or side walls when installed in ceiling.
- B. Set frames so that edge of frames without flanges will finish flush with surrounding finish surfaces.
- C. Set frames with flanges to overlap opening and so that face will be uniformly spaced from the finish surface.
- D. Set recessed panel access doors recessed so that face of surrounding materials will finish on the same plane, when finish in door is installed.

#### **3.3 ANCHORAGE**

- A. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through the frame members.
- B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.
- C. Anchors for fire-rated access doors shall meet requirements of applicable fire test.

#### **3.4 ADJUSTMENT**

- A. Adjust hardware so that door panel will open freely.
- B. Adjust door when closed so door panel is centered in the frame.

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**SECTION 08 71 00**  
**DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Door hardware and related items necessary for complete installation and operation of doors.

**1.2 RELATED WORK**

- A. Caulking: Section 07 92 00, JOINT SEALANTS.
- B. Application of Hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- C. Painting: Section 09 91 00, PAINTING.

**1.3 GENERAL**

- A. All hardware shall comply with UFAS, (Uniform Federal Accessible Standards) unless specified otherwise.
- B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).
- C. Hardware for Labeled Fire Doors and Exit Doors: Conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, large size, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.
- D. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.
- E. The following items shall be of the same manufacturer, except as otherwise specified:
  - 1. Mortise locksets.
  - 2. Hinges for hollow metal and wood doors.
  - 3. Surface-applied overhead door closers.
  - 4. Exit devices.

**1.4 WARRANTIES**

- A. Locks, latchsets: 5 years.
- B. Door closers and continuous hinges: 10 years.

### 1.5 MAINTENANCE MANUALS

- A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

### 1.6 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23. Submit 2 final copies of the final approved schedules to VAMC Locksmith as record copies (VISN Locksmith if the VAMC does not have a locksmith).

- B. Hardware Schedule: Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

- C. Samples and Manufacturers' Literature:

1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

- D. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

#### **1.7 DELIVERY AND MARKING**

- A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to Resident Engineer for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in Resident Engineer's office until all other similar items have been installed in project, at which time the Resident Engineer will deliver items on file to Contractor for installation in predetermined locations on the project.

#### **1.8 PRE-INSTALLATION MEETING**

- A. Convene a pre-installation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this section, including Contractor and Installer, Architect, Project Engineer and VA Locksmith, Hardware Consultant, and Hardware Manufacturer's Representative. Review the following:
1. Inspection of door hardware.
  2. Job and surface readiness.
  3. Coordination with other work.
  4. Protection of hardware surfaces.
  5. Substrate surface protection.
  6. Installation.
  7. Adjusting.
  8. Repair.
  9. Field quality control.
  10. Cleaning.

#### **1.9 INSTRUCTIONS**

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.

B. Keying: All cylinders shall be keyed into existing Best Grand Master Key System. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be 7 pin type. Keying information shall be furnished at a later date by the Resident Engineer.

1. Supply information regarding key control of cylinder locks to manufacturers of equipment having cylinder type locks. Notify Resident Engineer immediately when and to whom keys or keying information is supplied. Return all such keys to the Resident Engineer.

#### 1.10 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.

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

C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):

A156.1-06.....Butts and Hinges  
A156.2-03.....Bored and Pre-assembled Locks and Latches  
A156.3-08.....Exit Devices,  
A156.4-08.....Door Controls (Closers)  
A156.5-01.....Auxiliary Locks and Associated Products  
A156.6-05.....Architectural Door Trim  
A156.8-05.....Door Controls-Overhead Stops and Holders  
A156.16-08.....Auxiliary Hardware  
A156.18-06.....Materials and Finishes  
A156.21-09.....Thresholds  
A156.22-05.....Door Gasketing and Edge Seal Systems  
A156.23-04.....Electromagnetic Locks  
A156.25-07 .....Electrified Locking Devices  
A156.28-07 .....Master Keying Systems  
A156.30-03 .....High Security Cylinders  
A250.8-03.....Standard Steel Doors and Frames



- D. National Fire Protection Association (NFPA):  
80-10.....Fire Doors and Fire Windows  
101-09.....Life Safety Code
- E. Underwriters Laboratories, Inc. (UL):  
Building Materials Directory (2008)

## **PART 2 - PRODUCTS**

### **2.1 BUTT HINGES**

- A. ANSI A156.1. Provide only three-knuckle hinges, except five-knuckle where the required hinge type is not available in a three-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:
1. Exterior Doors: Type A2112/A5112 for doors 900 mm (3 feet) wide or less and Type A2111/A5111 for doors over 900 mm (3 feet) wide. Hinges for exterior outswing doors shall have non-removable pins. Hinges for exterior fire-rated doors shall be of stainless steel material.
  2. Interior Doors: Type A8112/A5112 for doors 900 mm (3 feet) wide or less and Type A8111/A5111 for doors over 900 mm (3 feet) wide. Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc. shall be of stainless steel material.
- B. Provide quantity and size of hinges per door leaf as follows:
1. Doors up to 1210 mm (4 feet) high: 2 hinges.
  2. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.
  3. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.
  4. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.
  5. Doors over 900 mm (3 feet) to 1065 mm (3 feet 6 inches) wide, standard weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
  6. Doors over 1065 mm (3 feet 6 inches) to 1210 mm (4 feet), heavy weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
  7. Provide heavy-weight hinges where specified.
  8. At doors weighing 330 kg (150 lbs.) or more, furnish 127 mm (inch High hinges.

9. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.

## **2.2 DOOR-CLOSING DEVICES**

- A. Closing devices shall be products of one manufacturer for each type specified.

## **2.3 OVERHEAD CLOSERS**

- A. Conform to ANSI A156.4, Grade 1.
- B. Closers shall conform to the following:
  1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
  2. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
  3. Material of closer body shall be forged or cast.
  4. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
  5. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
  6. Closers shall have full size metal cover; plastic covers will not be accepted.
  7. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.
  8. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
  9. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.

10. Provide parallel arm closers with heavy duty rigid arm.
11. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
12. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.

#### **2.4 DOOR STOPS**

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.
- E. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.
- F. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.
- G. Where the specified wall or floor stop cannot be used, provide surface-mounted where concealed cannot be used.

#### **2.5 OVERHEAD DOOR STOPS AND HOLDERS**

- A. Conform to ANSI Standard A156.8. Overhead holders shall be of sizes recommended by holder manufacturer for each width of door. Set overhead holders for 110 degree opening, unless limited by building construction or equipment. Provide Grade 1 overhead concealed slide type: stop-only at rated doors and security doors, hold-open type with exposed hold-open on/off control at all other doors requiring overhead door stops.

## 2.6 LOCKS AND LATCHES

- A. Conform to ANSI A156.13. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than seven pins. Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer's fire label. Provide temporary keying device or construction core of allow opening and closing during construction and prior to the installation of final cores.
- B. In addition to above requirements, locks and latches shall comply with the following requirements:
1. Mortise Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Provide lever design to match design selected by Architect or to match existing lever design.
  2. Auxiliary locks shall be as specified under

## 2.7 KEYS

- A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

Locks/Keys	Quantity
Cylinder locks	3 keys each
Cylinder lock change key blanks	10 each different key way
Master-keyed sets	6 keys each
Control key	2 keys

## **2.8 KICK PLATES**

- A. Conform to ANSI Standard A156.6.
- B. Provide protective plates as specified below:
  - 1. Kick plates, Type J100 series.
  - 2. Kick plates shall be 254 mm (10 inches) high. Kick shall be minimum 1.27 mm (0.062 inches) thick. On push side of doors where jamb stop extends to floor, make kick plates 51 mm (2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other kick plates to within 6 mm (1/4 inch) of each edge of doors. Kick plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.

## **2.9 EXIT DEVICES**

- A. Conform to ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of building. Trim shall have cast satin stainless steel lever handles of design similar to locksets, unless otherwise specified. Provide key cylinders for keyed operating trim and, where specified, cylinder dogging.
- B. Surface vertical rod panics shall only be provided less bottom rod; provide fire pins as required by exit device and door fire labels. Do not provide surface vertical rod panics at exterior doors.
- C. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

## **2.10 FLUSH BOLTS (LEVER EXTENSION)**

- A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.
- B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.
- C. Face plates for cylindrical strikes shall be rectangular and not less than 25 mm by 63 mm (1 inch by 2-1/2 inches).
- D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.

- E. Provide extension rods for top bolt where door height exceeds 2184 mm (7 feet 2 inches).

#### **2.11 DOOR PULLS WITH PLATES**

- A. Conform to ANSI A156.6. Pull Type J405, 203 mm (8 inches) high by 19 mm (3/4 inches) diameter with plate Type J301, 102 mm by 406 mm (4 inches by 16 inches), unless otherwise specified. Provide pull with projection of 70 mm (2 3/4 inches) and a clearance of 51 mm (2 inches).

#### **2.12 PUSH PLATES**

- A. Conform to ANSI A156.6. Metal, Type J405, 203 mm (4 inches) wide by 406 mm (16 inches) high. Provide metal Type J302 plates 100 mm (4 inches wide by 350 mm (14 inches) high).

#### **2.13 THRESHOLDS**

- A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.
- B. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.
- C. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) from frame face.

#### **2.14 WEATHERSTRIPS**

- A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length (0.000774m<sup>3</sup>/s/m).

#### **2.15 MISCELLANEOUS HARDWARE**

- A. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames, lead-lined frames and frames for sound-resistant, lightproof and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

## 2.16 FINISHES

- A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.
- B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.
- C. Miscellaneous Finishes:
1. Hinges --exterior doors: 626 or 630.
  2. Hinges --interior doors: 652 or 630.
  3. Door Closers: Factory-applied paint finish. Dull or Satin Aluminum color.
  4. Thresholds: Mill finish aluminum.

## 2.17 BASE METALS

- A. Apply specified U.S. Standard finishes on different base metals as following:

Finish	Base Metal
652	Steel
626	Brass or bronze
630	Stainless steel

## PART 3 - EXECUTION

### 3.1 HARDWARE HEIGHTS

- A. For new buildings locate hardware on doors at heights specified below, with all hand-operated hardware centered within 864 mm (34 inches) to 1200 mm (48 inches), unless otherwise noted:
- B. Hardware Heights from Finished Floor:
1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
  2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
  3. Deadlocks centerline of strike 1219 mm (48 inches).
  4. Hospital arm pull 1168 mm (46 inches) to centerline of bottom supporting bracket.

5. Centerline of door pulls to be 1016 mm (40 inches).
6. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
7. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.
8. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

### 3.2 INSTALLATION

- A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. Closers shall be mounted on side of door inside rooms, inside stairs, and away from corridors which shall have closer installed parallel arm on exterior side of doors. At exterior doors, closers shall be mounted on interior side. Where closers are mounted on doors they shall be mounted with sex nuts and bolts; foot shall be fastened to frame with machine screws.

B. Hinge Size Requirements:

Door Thickness	Door Width	Hinge Height
45 mm (1-3/4 inch)	900 mm (3 feet) and less	113 mm (4-1/2 inches)
45 mm (1-3/4 inch)	Over 900 mm (3 feet) but not more than 1200 mm (4 feet)	125 mm (5 inches)
35 mm (1-3/8 inch) (hollow core wood doors)	Not over 1200 mm (4 feet)	113 mm (4-1/2 inches)

- C. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.
- D. Where new hinges are specified for new doors in existing frames or existing doors in new frames, sizes of new hinges shall match sizes of existing hinges; or, contractor may reuse existing hinges provided hinges are restored to satisfactory operating condition as approved by Resident Engineer. Existing hinges shall not be reused on door openings having new doors and new frames. Coordinate preparation for hinge cut-outs and screw-hole locations on doors and frames.



E. Hinges Required Per Door:

Doors 1500 mm (5 ft) or less in height	2 butts
Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high	3 butts
Doors over 2280 mm (7 feet 6 inches) high	4 butts
Dutch type doors	4 butts
Doors with spring hinges 1370 mm (4 feet 6 inches) high or less	2 butts
Doors with spring hinges over 1370 mm (4 feet 6 inches)	3 butts

F. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal.

G. After locks have been installed; show in presence of Resident Engineer that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the Resident Engineer for his records.) Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

**3.3 FINAL INSPECTION**

A. Installer to provide letter to VA Resident/Project Engineer that upon completion, installer has visited the Project and has accomplished the following:

1. Re-adjust hardware.
2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
3. Identify items that have deteriorated or failed.
4. Submit written report identifying problems.

**3.4 DEMONSTRATION**

A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of Resident/Project Engineer and VA Locksmith.

### 3.5 HARDWARE SETS

- A. The following sets of hardware correspond to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.
- B. The Hardware Consultant working on the project will be responsible for providing additional information regarding these hardware sets. The numbers shown in the following sets come from BHMA standards.

ELECTRIC HARDWARE ABBREVIATIONS LEGEND:

ADO = Automatic Door Operator

EMCH = Electro-Mechanical Closer-Holder

MHO = Magnetic Hold-Open (wall- or floor-mounted)

**HARDWARE SET 1**

DOORS: 01

3	EA	HINGES	4 1/2 x 4 1/2 A5112	630	Other
1	EA	OFFICE LOCK	F04 x LEVER	630	Other
1	EA	CYLINDER	REMOVABLE CORE KEY TO EXISTING SYSTEM	626	Other
1	EA	DOOR CLOSER	CO2011 x TORX	ALUM	Other
1	EA	WALL STOP	LO2101	626	Other
1	EA	SELF-ADVESIVE	SEAL R0Y154		Other

**HARDWARE SET 2**

DOORS: 02

6	EA	HINGES	4 1/2 x 4 1/2 A5112	630	Other
1	SET	COMBINATION	FLUSH BOLT TYPE 27	626	Other
1	EA	DUST STRIKE	LO4021	626	Other
1	EA	OFFICE LOCK	F04 x LEVER	630	Other
1	EA	CYLINDER	REMOVABLE CORE KEY TO EXISTING SYSTEM	626	Other
1	EA	COORDINATOR	TYPE 21A	P	Other
2	EA	DOOR CLOSER	CO2011 x TORX	ALUM	Other
2	EA	ARMOR PLATE	J101 .062 GA. 36" x 1" LDW	630	Other
2	EA	MOP PLATE	J101 .062 GA. 4" x 1" LDW	630	Other
2	EA	WALL STOP	LO2101	626	Other
1	EA	SELF-ADVESIVE	SEAL R0Y154		Other
2	EA	DOOR SWEEP	ROY414	A	Other
1	SET	ASTRAGAL	SURFACE ROY825	A	Other

HARDWARE SET 3

DOORS: 03

1. ALL HARDWARE TO HAVE TORX SECURITY SCREWS.
2. FURNISH LOCKSET WITH BEHAVIORAL HEALTH TRIM SIMILAR TO SARGENT & CO. BHW TRIM.
3. CONFIRM DOUBLE CYLINDER INSTITUTIONAL LOCK WITH THE OWNER BEFORE ORDERING

6	EA	HINGES HW	4 1/2 x 4 1/2 A5111 x HT HOSPITAL TIPS x 630	Other
			SH x TORX S	
1	EA	DUST STRIKE	LO4021 x TORX SCREWS	626 Other
1	SET	COMBINATION	FLUSH BOLT TYPE 27 x TORX	626 Other
1	EA	INSTITUTIONAL L	F30 x DBL. CYL BHW BEHAVIORAL HEALTH TRIM x TORX	630 SARGENT
1	EA	DOUBLE CYLINDER COORDINATOR	INSTITUTIONAL. TYPE 21A x TORX	P Other
2	EA	DOOR CLOSER	CO2011 x TORX	ALUM Other
1	EA	WALL STOP	LO2101	626 Other
1	EA	ASTRAGAL	STEEL OVERLAPPING x TORX SCREWS	P Other
2	EA	INSTALL ON SECURE SIDE. SILENCERS	L03011	Other

- - - END - - -

**SECTION 08 80 00**  
**GLAZING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies glass, related glazing materials and accessories. Glazing products specified apply to factory- or field-glazed items.

**1.2 RELATED WORK**

- A. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.

**1.3 LABELS**

- A. Temporary labels:

1. Provide temporary label on each light of glass material, identifying manufacturer or brand and glass type, quality and nominal thickness.
2. Label in accordance with NFRC (National Fenestration Rating Council) label requirements.
3. Temporary labels shall remain intact until glazing material is approved by Resident Engineer.

- B. Permanent labels:

1. Locate in corner for each pane.
2. Label in accordance with ANSI Z97.1 and SGCC (Safety Glass Certification Council) label requirements.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Glass Thickness:

1. Test in accordance with ASTM E 1300.
2. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

### **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Manufacturer's Certificates:
  - 1. Certificates stating that wire glass meets requirements for safety glazing material as specified in ANSI Z97.1.
  - 2. Certificate on shading coefficient.
  - 3. Certificate on "R" value when value is specified.
- C. Warranty: Submit written guaranty, conforming to General Condition requirements, and to "Warranty of Construction" Article in this Section.
- D. Manufacturer's Literature and Data:
  - 1. Glass, each kind required.
  - 2. Glazing cushion.
  - 3. Sealing compound.
- E. Samples:
  - 1. Size: 150 mm by 150 mm (6 inches by 6 inches).
- F. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates, and for compatibility with glass and other glazing materials.

### **1.6 DELIVERY, STORAGE AND HANDLING**

- A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.
- B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.
- C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.
- D. Protect laminated security glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location. Provide protective covering on exposed faces of glazing plastics, and mark inside as "INTERIOR FACE" or "PROTECTED FACE":

1. Treat security glazing as fragile merchandise, and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling shall comply with Manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.
2. Protect sealed-air-space insulating glazing units from exposure to abnormal pressure changes, as could result from substantial changes in altitude during delivery by air freight. Provide temporary breather tubes which do not nullify applicable warranties on hermetic seals.
3. Temporary protections: The glass front and polycarbonate back of glazing shall be temporarily protected with compatible, peelable, heat-resistant film which will be peeled for inspections and re-applied and finally removed after doors and windows are installed at destination. Since many adhesives will attack polycarbonate, the film used on exposed polycarbonate surfaces shall be approved and applied by manufacturer.
4. Edge protection: To cushion and protect glass clad, polycarbonate, and Noviflex edges from contamination or foreign matter, the four edges shall be sealed the depth of glazing with continuous standard-thickness Santoprene tape. Alternatively, continuous channel shaped extrusion of Santoprene shall be used, with flanges extending into face sides of glazing.
5. Protect "Constant Temperature" units including every unit where glass sheet is directly laminated to or directly sealed with metal-tube type spacer bar to polycarbonate sheet, from exposures to ambient temperatures outside the range of 16 to 24 C, during the fabricating, handling, shipping, storing, installation, and subsequent protection of glazing.

#### **1.7 PROJECT CONDITIONS**

- A. Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field-measured products.

## 1.8 WARRANTIES

- A. Warranty: Conform to terms of "Warranty of Construction", FAR clause 52.246-21, except extend warranty period for the following:
1. Insulating glass units to remain sealed for 10 years.
  2. Laminated glass units to remain laminated for 5 years.

## 1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
- Z97.1-09.....Safety Glazing Material Used in Building -  
Safety Performance Specifications and Methods  
of Test.
- C. American Society for Testing and Materials (ASTM):
- C542-05.....Lock-Strip Gaskets
- C716-06.....Installing Lock-Strip Gaskets and Infill  
Glazing Materials.
- C794-10.....Adhesion-in-Peel of Elastomeric Joint Sealants
- C864-05.....Dense Elastomeric Compression Seal Gaskets,  
Setting Blocks, and Spacers
- C920-11.....Elastomeric Joint Sealants
- C964-07.....Standard Guide for Lock-Strip Gasket Glazing
- C1036-06.....Flat Glass
- C1048-12.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated  
and Uncoated Glass.
- C1376-10.....Pyrolytic and Vacuum Deposition Coatings on  
Flat Glass
- D635-10.....Rate of Burning and/or Extent and Time of  
Burning of Self-Supporting Plastic in a  
Horizontal Position
- D4802-10.....Poly (Methyl Methacrylate) Acrylic Plastic  
Sheet
- E84-10.....Surface Burning Characteristics of Building  
Materials
- E119-10.....Standard Test Methods for Fire Test of Building  
Construction and Material
- E2190-10.....Insulating Glass Unit



D. Commercial Item Description (CID):

A-A-59502.....Plastic Sheet, Polycarbonate

E. Code of Federal Regulations (CFR):

16 CFR 1201 - Safety Standard for Architectural Glazing Materials; 2010

F. National Fire Protection Association (NFPA):

80-13.....Fire Doors and Windows.

252-12.....Standard Method of Fire Test of Door Assemblies

257-12.....Standard on Fire Test for Window and Glass

Block Assemblies

G. National Fenestration Rating Council (NFRC)

H. Safety Glazing Certification Council (SGCC) 2012:

Certified Products Directory (Issued Semi-Annually).

I. Underwriters Laboratories, Inc. (UL):

752-11.....Bullet-Resisting Equipment.

J. Unified Facilities Criteria (UFC):

4-010-01-2012.....DOD Minimum Antiterrorism Standards for

Buildings

K. Glass Association of North America (GANA):

Glazing Manual (Latest Edition)

Sealant Manual (2009)

L. American Society of Civil Engineers (ASCE):

ASCE 7-10.....Wind Load Provisions

**PART 2 - PRODUCTS**

**2.1 GLASS**

A. Use thickness stated unless specified otherwise in assemblies.

B. Clear Glass:

1. ASTM C1036, Type I, Class 1, Quality q3.

2. Thickness, as indicated.

C. Wired Flat Glass:

1. ASTM C1036, Type II, Class 1, Form 1, Pattern Pl, Finish F1, Quality m1.

2. Thickness, 6 mm (1/4 inch).

## **2.2 FIRE-RESISTANT GLASS WITHOUT WIRE MESH**

- A. Type 1 (Transparent float glass), Class 1 (Clear).
- B. Fire-protective glass products used to protect against smoke and flames only shall be rated for [20] [45] minutes as required by local building code, and shall be tested in accordance with NFPA 252 (Standard Methods of Fire Tests of Door Assemblies) and NFPA 257 (Standard on Fire Test for Window and Glass Block Assemblies)
- C. Fire-resistive products used to protect against smoke, flame, and the transmission of radiant heat shall be rated for [60] [90] [120] minutes, and shall be tested in accordance with NFPA 252, NFPA 257, and ASTM E119 (Standard Test Methods for Fire Tests of Building Construction and Materials).
- D. Fire-rated glass or glass assembly shall be classified by Underwriters Laboratory (UL), Intertek Testing Services- Warnock Hersey (ITS-WHI) or any other OSHA certified testing laboratory. All glass shall bear a permanent mark of classification in accordance with local building code.
- E. Maximum size is per the manufacturer's test agency listing for doors, transoms, side lights, borrowed lights, and windows.
- F. Where safety glazing is required by local building code, fire-rated glass shall be tested in accordance with CPSC 16 CFR 1201 Category I or II and bear a permanent mark of classification.
  - 1. Category I products are limited to 0.84 m<sup>2</sup> - 9 ft<sup>2</sup> and tested to no less than 203 Nm-150 ft-lbs impact loading.
  - 2. Category II products are greater than 0.84 m<sup>2</sup> - 9 ft<sup>2</sup> and tested to no less than 542 Nm-400 ft-lbs impact loading. Category II products can be used in lieu of Category I products.

## **2.3 GLAZING ACCESSORIES**

- A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.
- B. Setting Blocks: ASTM C864:
  - 1. Channel shape; having 6 mm (1/4 inch) internal depth.
  - 2. Shore a hardness of 80 to 90 Durometer.
  - 3. Block lengths: 50 mm (two inches) except 100 to 150 mm (four to six inches) for insulating glass.

4. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
  5. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.
- C. Spacers: ASTM C864:
1. Channel shape having a 6 mm (1/4 inch) internal depth.
  2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
  3. Lengths: One to 25 to 76 mm (one to three inches).
  4. Shore a hardness of 40 to 50 Durometer.
- D. Sealing Tapes:
1. Semi-solid polymeric based material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
  2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
- E. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.
- F. Glazing Sealants: ASTM C920, silicone neutral cure:
1. Type S.
  2. Class 25
  3. Grade NS.
  4. Shore A hardness of 25 to 30 Durometer.
- G. Neoprene, EPDM, or Vinyl Glazing Gasket: ASTM C864.
1. Channel shape; flanges may terminate above the glazing channel or flush with the top of the channel.
  2. Designed for dry glazing.
- H. Color:
1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be non-staining.
  2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.
- I. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units intended for removal for smoke control. Comply with requirements of local Fire Department.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verification of Conditions:
  - 1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
  - 2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer's approved shop drawings.
- B. Advise Contractor of conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation: Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 Sealant Manual.
- B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.
- C. Shop-fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.
- D. Verify that components used are compatible.
- E. Clean and dry glazing surfaces.
- F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

### **3.3 INSTALLATION - GENERAL**

- A. Install in accordance with GANA-01 Glazing Manual and GANA-02 Sealant Manual unless specified otherwise.
- B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.
- C. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Glaze doors in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Fire-Resistant Glass:
  - 1. Wire glass: Glaze in accordance with NFPA 80.
  - 2. Other fire-resistant glass: Glaze in accordance with UL design requirements.

### **3.4 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)**

- A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- E. Fill gaps between pane and applied stop with manufacturer's recommended sealant to depth equal to bite on glazing, to uniform and level line.
- F. Trim protruding tape edge.

### **3.5 REPLACEMENT AND CLEANING**

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by Resident Engineer.
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

### **3.6 PROTECTION**

- A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

### **3.7 GLAZING SCHEDULE**

- A. Fire-Resistant Glass:
  - 1. Install clear wire glass in interior fire-rated or labeled doors.

- - - E N D - - -



**SECTION 08 90 00  
LOUVERS AND VENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies door louvers and wall vents.

**1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Shop Drawings:
1. Each type, showing material, finish, size of members, operating devices, method of assembly, and installation and anchorage details.
- C. Manufacturer's Literature and Data:
1. Each type of louver and vent.

**1.3 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The Master Painters Institute (MPI):
- Approved Product List - September 2011
- C. American Society for Testing and Materials (ASTM):
- A167-99(R2009).....Stainless and Heat-Resisting Chromium - Nickel  
Steel Plate, Sheet, and Strip
- A1008/A1008M-10.....Steel, Sheet, Carbon, Cold Rolled, Structural,  
and High Strength Low-Alloy with Improved  
Formability
- B209/B209M-03(R2007)....Aluminum and Aluminum Alloy, Sheet and Plate
- B221-08.....Aluminum and Aluminum Alloy Extruded Bars,  
Rods, Wire, Shapes, and Tubes
- B221M-07.....Aluminum and Aluminum Alloy Extruded Bars,  
Rods, Wire Shapes, and Tubes
- D. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500-06.....Metal Finishes Manual
- E. National Fire Protection Association (NFPA):
- 90A-09.....Installation of Air Conditioning and  
Ventilating Systems

- F. American Architectural Manufacturers Association (AAMA):  
2605-11.....High Performance Organic Coatings on  
Architectural Extrusions and Panels
- G. Air Movement and Control Association, Inc. (AMCA):  
500-L-07.....Testing Louvers

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Stainless Steel: ASTM A167, Type 302B.
- C. Carbon Steel: ASTM A1008/A1008M.
- D. Aluminum, Plate and Sheet: ASTM B209/B209M.
- E. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or shown, shall be toggle or expansion bolts, of size and type as required for each specific type of installation and service condition.
1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
2. Fasteners for louvers, louver frames, and wire guards shall be of stainless steel or aluminum.
- F. Inorganic Zinc Primer: MPI No. 19.

### **2.2 INTERIOR DOOR LOUVERS**

- A. Fabricate louvers for interior doors and partitions of 1.2 mm (0.0478-inch) thick steel.
- B. Make louvers sight-proof type with stationary blades, except where light-proof louvers are required.
- C. Lightproof louvers shall have stationary blades and be designed to exclude passage of light but permit free ventilation.

### **2.3 WALL VENTS**

- A. Fabricate exterior wall vents from either 4.7 mm (0.187-inch) thick aluminum plate of 6 mm (1/4-inch) thick cast iron, perforated in diamond lattice pattern, with not over 19 mm (3/4-inch) openings.
- B. Vents shall have aluminum screen frame with aluminum alloy insect screening mounted on back of vent by means of 19 mm x 5 mm (3/4-inch by 3/16-inch) top and bottom bars screwed to grille.



- C. Vent Frames In Masonry: Fabricate of 45 mm x 30 mm x 5 mm (1-3/4 inch by 1-1/4 inch by 3/16-inch) steel angles bolted with 6 mm (1/4-inch) diameter expansion bolts at jambs.

#### **2.4 BRICK VENTS**

- A. Vents shall be of size shown formed of approximately 3 mm (0.125 inch) thick cast aluminum, or 3 mm (0.125) inch extruded aluminum.
- B. Provide vents complete with aluminum screen frame with corrosion resistant insect screening mounted on back of vent.
- C. Provide vents with required anchors.

#### **2.5 FINISH**

- A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505
- B. Aluminum Louvers, Air Intake Vents:
1. Anodized finish
    - a. Chemically-etched medium matte, with clear anodic coating, Class I Architectural, 0.7 mils thick.
- C. Aluminum Wall Vents and Brick Vents: Sand-blasted satin finish.
- D. Stainless Steel: Mechanical finish No. 4 in accordance with NAAMM Metal Finishes Manual.
- E. Sheet Steel: Baked-on or oven dried shop prime coat.
1. Paint interior surfaces of lightproof louvers with two additional finish shop coats of baked-on flat black enamel.
  2. Finish painting of exposed surfaces of shop primed louvers is specified in Section 09 91 00, PAINTING.
- F. Steel: Surfaces of steel work, for which no other finish is specified, shall be cleaned free from scale, rust, oil and grease, and then given a light colored prime paint after fabrication, except ferrous metals concealed in finished work. Paint all contact surfaces of assembled work (except welded contact surfaces) with an additional shop coat of similar paint.

#### **2.6 PROTECTION**

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous paint (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.

- B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.
- C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work. Strippable plastic coating on finish is not approved.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.
- C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers and vents to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.
- D. Generally, set louvers and vents in masonry walls during progress of the work. If louvers and vents are not delivered to job in time for installation in prepared openings, make provision for later installation. Set in cast-in-place concrete in prepared openings.

#### **3.2 CLEANING AND ADJUSTING**

- A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum shall be cleaned as recommended by the manufacturer and protected from damage until completion of the project.
- B. All movable parts, including hardware, shall be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components.

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VA Project No. 693-12-106  
AE Works Project No. 13003

Wilkes-Barre VAMC  
Upgrade Elevators 7 and 8

VA Master 10-11

**SECTION 09 06 00  
SCHEDULE FOR FINISHES**

**SECTION 09 06 00-SCHEDULE FOR FINISHES**

VAMC: Wilkes-Barre VAMC  
Location: Wilkes-Barre, Pennsylvania  
Project No. and Name: Upgrade Elevators 7 and 8 693-12-106  
Submission: Bid Documents  
Date: 10/3/2013

**SECTION 09 06 00**  
**SCHEDULE FOR FINISHES**

**PART I - GENERAL**

**1.1 DESCRIPTION**

- A. This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.

**1.2 MANUFACTURERS**

- A. Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturers' equivalents to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

**1.3 SUBMITALS**

- A. Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES —provide quadruplicate samples for color approval of materials and finishes specified in this section.

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. MASTER PAINTING INSTITUTE: (MPI)  
2001.....Architectural Painting Specification Manual

**PART 2- PRODUCTS**

**2.1 DIGITAL COLOR PHOTOS**

- A. Size 24 x 35 mm.
- B. Labeled for:
  - 1. Building name and Number.
  - 2. Room Name and Number.

**2.2 DIVISION 09 - FINISHES**

A. SECTION 09 51 00, ACOUSTICAL CEILINGS

Finish Code	Component	Color Pattern	Manufacturer	Mfg Name/No.
	Exposed Suspension System	White	Armstrong	To match existing VA Standards
	Ceiling Tile	White	Armstrong	Tech Zone to match existing VA Standards

B. SECTION 09 67 23, EPOXY RESINOUS FLOORING (ERF)

Finish code	Manufacturer	Mfg. Color Name/No.
	StoneHard	Quartz Flake Epoxy

C. SECTION 09 72 00, HYGIENIC VINYL WALLCOVERING

HEAT FORMABLE HYGIENIC WALL SYSTEM PANELS		
Location	Manufacturer	Mfg. Color Name/No.
Elevator Lobby WC3	Altro	Whiterock Linen
Elevator Lobby WC1	Altro	Whiterock Chameleon Distant Thunder
Elevator Lobby WC2	Altro	Whiterock Chameleon Ice Queet

D. SECTION 09 91 00, PAINT AND COATINGS

1. MPI Gloss and Sheen Standards

		Gloss @60	Sheen @85
Gloss Level 1	a traditional matte finish-flat	max 5 units, and	max 10 units
Gloss Level 2	a high side sheen flat-"a velvet-like" finish	max 10 units, and	10-35 units
Gloss Level 3	a traditional "egg-shell like" finish	10-25 units, and	10-35 units
Gloss Level 4	a "satin-like" finish	20-35 units, and	min. 35 units
Gloss Level 5	a traditional semi-gloss	35-70 units	
Gloss Level 6	a traditional gloss	70-85 units	
Gloss level 7	a high gloss	more than 85 units	

2. Paint code	Gloss	Manufacturer	Mfg. Color Name/No.
P			
P			
P			

## 2.4 DIVISION 10 - SPECIALTIES

### A. INTERIOR SIGNS

Sign Type	Component	Manufacturer	Mfg. Color Name/No.

## 2.5 DIVISION 13 - SPECIAL CONSTRUCTION

### A. SECTION 14 21 00, ELECTRIC TRACTION ELEVATORS

Elevator	Component	Material	Finish	Color
Service Elevators 7 and 8	Hoistway Entrance	Stainless Steel	Polished	
	Hoistway Doors	Stainless Steel	Polished	
	Corridor Position Indicator and Call Buttons	Stainless Steel	Polished	
	Car Canopy	Stainless Steel		
	Car Wainscot	Stainless Steel	Brushed	
	Panels Above Wainscot	Stainless Steel	Brushed	
	Car Floor	Stainless Steel	Algrip Slip Resistant	
	Car Operating Panel	Stainless Steel	Brushed	

**PART 3 - EXECUTION**

**3.1 FINISH SCHEDULES & MISCELLANEOUS ABBREVIATIONS**

FINISH SCHEDULE & MISCELLANEOUS ABBREVIATIONS	
Term	Abbreviation
Acoustical Ceiling	AT
Concrete	C
Concrete Masonry Unit	CMU
Epoxy Coating	EC
Epoxy Resin Flooring	ERF

Existing	E
Exposed Divider Strips	EXP
Gypsum Wallboard	GWB
Material	MAT
Paint	P
Quarry Tile	QT
Wall Border	WB
Wood	WD

**3.2 FINISH SCHEDULE SYMBOLS**

Symbol Definition

\*\* Same finish as adjoining walls  
- No color required  
E Existing  
XX To match existing  
EFTR Existing finish to remain  
RM Remove

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**SECTION 09 51 00**  
**ACOUSTICAL CEILINGS**

**PART 1- GENERAL**

**1.1 DESCRIPTION**

- A. Metal ceiling suspension system for acoustical ceilings.
- B. Acoustical units.
- C. Adhesive applications.

**1.2 RELATED WORK**

- A. Color, pattern, and location of each type of acoustical unit:  
Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Access doors in adhesively-applied tile: Section 08 31 13, ACCESS DOORS  
AND FRAMES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA  
and SAMPLES.
- B. Samples:
  - 1. Acoustical units, each type, with label indicating conformance to  
specification requirements, including units specified to match  
existing.
  - 2. Colored markers for units providing access.
- C. Manufacturer's Literature and Data:
  - 1. Ceiling suspension system, each type, showing complete details of  
installation.
  - 2. Acoustical units, each type.
- D. Manufacturer's Certificates: Acoustical units, each type, in accordance  
with specification requirements.

**1.4 DEFINITIONS**

- A. Standard definitions as defined in ASTM C634.
- B. Terminology as defined in ASTM E1264.

**1.5 APPLICABLE PUBLICATIONS**

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

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

- A641/A641M-03.....Zinc-coated (Galvanized) Carbon Steel Wire
- A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
- C423-07.....Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C634-02 (E2007).....Standard Terminology Relating to Environmental Acoustics
- C635-04.....Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
- C636-06.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
- E84-07.....Surface Burning Characteristics of Building Materials
- E119-07.....Fire Tests of Building Construction and Materials
- E413-04.....Classification for Rating Sound Insulation.
- E580-06.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
- E1264-(R2005).....Classification for Acoustical Ceiling Products

**PART 2- PRODUCTS**

**2.1 METAL SUSPENSION SYSTEM**

- A. ASTM C635, heavy-duty system, except as otherwise specified.
1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
    - a. Galvanized cold-rolled steel, bonderized.
    - b. Extruded aluminum.
    - c. Fire-resistant plastic (glass fiber) having a flame spread and smoke developed rating of not more than 25 when tested in accordance with ASTM E84.
  2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.

3. Use aluminum suspension in kitchens and aluminum or fire-resistant plastic in toilets adjacent to shower areas, hydrotherapy, and swimming pools.
- B. Exposed grid suspension system for support of lay-in panels:
  1. Exposed grid width not less than 22 mm (7/8 inch) with not less than 8 mm (5/16 inch) panel bearing surface.
  2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
  3. On exposed metal surfaces, apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Concealed grid suspension system (for support of mineral base acoustical tile):
  1. Concealed grid upward access suspension system to provide an initial opening of 300 mm by 600 mm (12 by 24 inches) and for removal of adjacent runners and tile without the use of special tools, and without damage to suspension system and acoustical tile.
  2. Minimum flange width of 22 mm (7/8 inch) except for access hook and angle.
  3. Minimum flange width of 11 mm (7/16 inch) for access hook and angle.
- D. Suspension system for support of Metal Type V, VI, and VII tiles:

Concealed grid type having runners designed for the snap-in attachment of metal tile (pans).

## **2.2 PERIMETER SEAL**

- A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 9 mm (3/8 inch) wide strip.

## **2.3 WIRE**

- A. ASTM A641.
- B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).
- C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

## **2.4 ANCHORS AND INSERTS**

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.
- B. Hanger Inserts:
  - 1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
  - 2. Nailing type option for wood forms:
    - a. Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).
    - b. Lower portion provided with not less than 8 mm (5/16 inch) hole to permit attachment of hangers.
  - 3. Flush ceiling insert type:
    - a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
    - b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
    - c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.
- C. Clips:
  - 1. Galvanized steel.
  - 2. Designed to clamp to steel beam or bar joists, or secure framing member together.
  - 3. Designed to rigidly secure framing members together.
  - 4. Designed to sustain twice the loads imposed by hangers or items supported.
- D. Tile Splines: ASTM C635.

## 2.5 CARRYING CHANNELS FOR SECONDARY FRAMING

- A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.
- B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

## 2.6 ADHESIVES

- A. ASTM D1779, having flame spread index of 25 or less when tested in accordance with ASTM E84.
- B. Developing minimum strength of 7 kg/m<sup>2</sup> (one psi) of contact surface 48 hours after installation in temperature of 21 °C (70 °F).

## 2.7 ACOUSTICAL UNITS

- A. General:
1. Ceiling Tile shall meet minimum 37% bio-based content in accordance with USDA Bio-Preferred Product requirements.
  2. ASTM E1264, weighing 3.6 kg/m<sup>2</sup> (3/4 psf) minimum for mineral fiber panels or tile.
  3. Class A Flame Spread: ASTM 84
  4. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
  5. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
  6. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces, except as specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
  7. Lay-in panels: Sizes as shown, with panel edges to match existing.
  8. Tile for concealed grid upward access system: Optional 300 by 300 or 300 by 600 mm (12 by 12 or 12 by 24 inch) size.
    - a. Cross score 300 by 600 mm (12 by 24 inch) tile to simulate 300 by 300 mm (12 by 12 inch) tile edges.
    - b. Provide tile with edges and joints as required to suit suspension and access system.

- B. Type III Units - Mineral base with water-based painted finish less than 10 g/l VOC, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick. Mineral base to contain minimum 65 percent recycled content.
- C. Type IV Units - Mineral base with membrane-faced overlay, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick. Apply over the paint coat on the face of the unit a poly (vinyl) chloride overspray having a flame spread index of 25 or less when tested in accordance with ASTM E84.
- D. Type III-A Units - Mineral base with painted finish.
  - 1. Form 1, modular, cast or molded.
  - 2. Minimum NRC of 0.75.
  - 3. Minimum thickness of 19 mm (3/4 inch) and weight of 4.9 Kg/sq m (one pound per square foot).

## **2.9 ACCESS IDENTIFICATION**

- A. Markers:
  - 1. Use colored markers with pressure sensitive adhesive on one side.
  - 2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.
- B. Use markers of the same diameter throughout building.
- C. Color Code: Use following color markers for service identification:

Color.....	Service
Red.....	Sprinkler System: Valves and Controls
Green.....	Domestic Water: Valves and Controls
Yellow.....	Chilled Water and Heating Water
Orange.....	Ductwork: Fire Dampers
Blue.....	Ductwork: Dampers and Controls
Black.....	Gas: Laboratory, Medical, Air and Vacuum

## **PART 3 EXECUTION**

### **3.1 CEILING TREATMENT**

- A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.
- B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.

C. Moldings:

1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.

D. Perimeter Seal:

1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

E. Existing ceiling:

1. Where extension of existing ceilings occur, match existing.
2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

**3.2 CEILING SUSPENSION SYSTEM INSTALLATION**

A. General:

1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
3. Support a maximum area of 1.48 m<sup>2</sup> (16 sf) of ceiling per hanger.
4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 1200 mm (48 inches) in length.

8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Anchorage to Structure:

1. Concrete:

- a. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.

2. Steel:

- a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.
  - (1) Size and space carrying channels to ensure that the maximum deflection specified will not be exceeded.
  - (2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
- b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fire proofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
- c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

B. Direct-Hung Suspension System:

1. As illustrated in ASTM C635.
2. Support main runners by hanger wires attached directly to the structure overhead.
3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

C. Indirect-Hung Suspension System:

1. As illustrated in ASTM C635.
2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels not more than 2400 mm (8 feet) on center or for carrying



channels less than 1200 mm (4 feet) or center so as to insure that specified requirements are not exceeded.

3. Support main runners by specially designed clips attached to carrying channels.

D. Seismic Ceiling Bracing System:

1. Construct system in accordance with ASTM E580.
2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

**3.3 ACOUSTICAL UNIT INSTALLATION**

- A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.
  1. Install tile to lay level and in full contact with exposed grid.
  2. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.
- C. Tile in concealed grid upward access suspension system:
  1. Install acoustical tile with joints close, straight and true to line, and with exposed surfaces level and flush at joints.
  2. Make corners and arises full, and without worn or broken places.
  3. Locate acoustical units providing access as specified under Article, ACCESS.
- D. Adhesively-applied tile:
  1. Condition of surface shall be in accordance with ASTM D1779, Note 1, Cleanliness of Surface, and Note 4, Rigidity of Base Surface.
  2. Size or seal surface as recommended by manufacturer of adhesive and allow to dry before installing units.
- E. Markers:
  1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.
  2. Attach colored markers to exposed grid on opposite sides of the units providing access.
  3. Attach marker on exposed ceiling surface of upward access acoustical unit.

### 3.5 CLEAN-UP AND COMPLETION

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.
- B. Leave finished work free from defects.

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**SECTION 09 67 23.30**  
**RESIN (EPOXY RESIN COMPOSITION) MORTAR FLOORING (RES-3)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies a seamless resinous (epoxy resin composition) and aliphatic poly urethane sealer, flooring systems with integral cove base.

**1.2 RELATED WORK**

- A. Color and location of each type of resinous (epoxy resin composition) flooring: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Manufacturer's Literature and Data:
1. Description of each product to be provided.
  2. Application and installation instructions.
  3. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.
- C. Qualification Data: For Installer.
- D. Sustainable Submittal:
1. Product data for products having recycled content, submit documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
    - a. Include statements indicating costs for each product having recycled content, and low-emitting materials.
- E. Samples:
1. Each color and texture specified in Section 09 06 00, SCHEDULE FOR FINISHES.
  2. Samples for verification: For each (color and texture) resinous flooring system required, 6 inches (152 mm) square, applied to a rigid backing by installer for this project.
  3. Sample showing construction from substrate to finish surface in thickness specified and color and texture of finished surfaces. Finished flooring must match the approved samples in color and texture.

F. Shop Drawings: Include plans, sections, component details, and attachment to other trades. Indicate layout of the following:

1. Patterns.
2. Edge configurations.

G. Certifications and Approvals:

1. Manufacturer's certification of material and substrate compliance with specification.
2. Manufacturer's approval of installers.
3. Contractor's certificate of compliance with Quality Assurance requirements.

H. Warranty: As specified in this section.

#### **1.4 QUALITY ASSURANCE**

A. Manufacture Certificate: Manufacture shall certify that a particular resinous flooring system has been in use for a minimum of (5) five years.

B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this project for a minimum period of (5) five years, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
2. Contractor shall have completed at least (5) five projects of similar size and complexity. Include list of at least (5) five projects. List must include owner (purchaser); address of installation, contact information at installation project site; and date of installation.
3. Installer's Personnel: Employ persons trained for application of specified product.

C. Source Limitations:

1. Obtain primary resinous flooring materials including primers, resins, hardening agents, grouting coats and finish or sealing coats from a single manufacturer.
2. Provide secondary materials, including patching and fill material, joint sealant, and repair material of type and from source recommended by manufacturer of primary materials.

D. Pre-Installation Conference:

1. Convene a meeting not less than thirty days prior to starting work.
2. Attendance:
  - a. Contractor
  - b. VA Resident Engineer
  - c. Manufacturer and Installer's Representative
3. Review the following:
  - a. Environmental requirements
    - 1) Air and surface temperature
    - 2) Relative humidity
    - 3) Ventilation
    - 4) Dust and contaminants
  - b. Protection of surfaces not scheduled to be coated
  - c. Inspect and discuss condition of substrate and other preparatory work performed
  - d. Review and verify availability of material; installer's personnel, equipment needed
  - e. Design, patterns and edge conditions.
  - f. Performance of the coating with chemicals anticipated in the area receiving the resinous (epoxy resin composition) flooring system
  - g. Application and repair
  - h. Field quality control
  - i. Cleaning
  - j. Protection of coating systems
  - k. One-year inspection and maintenance
  - l. Coordination with other work

E. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of resinous flooring systems.

- F. Contractor Job Site Log: Contractor shall document daily; the work accomplished environmental conditions and any other condition event significant to the long term performance of the resinous flooring systems installation. The Contractor shall maintain these records for one year after Substantial Completion.

#### **1.5 MATERIAL PACKAGING DELIVERY AND STORAGE**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Protect materials from damage and contamination in storage or delivery, including moisture, heat, cold, direct sunlight, etc.
- C. Maintain temperature of storage area between 60 and 80 degrees F (15 and 26 degrees C).
- D. Keep containers sealed until ready for use.
- E. Do not use materials beyond manufacturer's shelf life limits.
- F. Package materials in factory pre-weighed and in single, easy to manage batches sized for ease of handling and mixing proportions from entire package or packages. No on-site weighing or volumetric measurements are allowed.

#### **1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring applications.
  - 1. Maintain material and substrate temperature between 65 and 85 degrees F (18 and 30 degrees C) during resinous flooring application and for not less than 24 hours after application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
- D. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

#### 1.7 WARRANTY

- A. Work subject to the terms of the Article "Warranty of Construction" FAR clause 52.246-21.
- B. Warranty: Manufacture shall furnish a single written warranty covering the full assembly, for both material and workmanship, for an extended period of (3) full years from date of installation; or provide a joint and several warranty signed on a single document by manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (3) full years from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

#### 1.8 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - B221-08.....Standard Specification for Aluminum and Aluminum-Alloy, Extruded Bars, Rods, Wire, Profiles and Tubes.
  - C307-03 (2008).....Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
  - C413-01(2006).....Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes
  - C531-00(R2005).....Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes
  - C579-01(2006).....Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
  - C580-02(2008).....Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes

- C811-98(2008).....Standard Practice for Surface Preparation of  
Concrete for Application of Chemical-Resistant  
Resin Monolithic Surfacing
- D1308-02(2007).....Standard Test Method for Effect of Household  
Chemicals on Clear and Pigmented Organic  
Finishes
- D2240-05.....Standard Test Method for Rubber Property –  
Durometer Hardness
- D4060-07.....Standard Test Method for Abrasion Resistance of  
Organic Coatings by the Taber Abraser
- D4226-09.....Standard Test Methods for Impact Resistance of  
Rigid Poly (Vinyl Chloride) (PVC) Building  
Products
- D7234-05.....Standard Test Method for Pull-Off Adhesion  
Strength of Coatings on Concrete Using Portable  
Pull-Off Adhesion Testers
- F1869-09.....Standard Test Method for Measuring Moisture  
Vapor Emission Rate of Concrete Subfloor Using  
Anhydrous Calcium Chloride
- F2170-09.....Standard Test Methods for Determining Relative  
Humidity in Concrete Floor Slabs Using Situ  
Probes
- C. National Association of Architectural Metal Manufacturers (NAAMM):  
AMP 500-06.....Finishes for Aluminum



## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION FOR RESINOUS FLOORING**

#### **A. System Description:**

1. Monolithic, multi-component epoxy chemistry, steel trowel-applied resinous flooring mortar system, nominal 3/16-inch/5-mm thick system comprised of a penetrating primer, multi-component 100% solids epoxy mortar, grout coat sealer and clear VOC compliant, aliphatic polyurethane non-reflective finish.
2. Decorative quartz broadcast systems will not be accepted. Steel trowel-finished mortars only.

#### **B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation and clean up.**

#### **C. System Components: Verify specific requirements as systems vary by manufacturer. Verify mortar base product; built-up layers of broadcast systems will not be accepted. Verify compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:**

1. Primer (Bond) Coat: Verify inclusion of primer in manufacturer's system.
  - a. Resin: Epoxy.
  - b. Formulation Description: 100% solids.
  - c. Application Method: Apply by Squeegee and finish roller.
2. Mortar (Base) Coat: Verify mortar composition.
  - a. Resin: Epoxy.
  - b. Formulation Description: 100% solids, UV stable.
  - c. Application Method: Screed and steel finish trowel.
    - 1) Thickness of coat: Verify thickness as systems vary by manufacturer; approximately from 3/16 to 1/4 inch (4.76 to 6.35 mm).
  - d. Aggregate: Pigmented color quartz silica, and a minimum or 12% recycled glass aggregates integral component to mortar.
3. Grout Coat: Verify inclusion of base coat in manufacturer's system.
  - a. Resin: Epoxy.
  - b. Formulation Description: 100-percent solids, UV stable.
  - c. Application Method: Flat squeegee and roller applied.
  - d. Number of coats: (2) two, wet on wet application.

4. Top (Seal) Coat: Verify inclusion of water-based aliphatic polyurethane sealer coat as systems vary by manufacturer.
  - a. Resin: multi-component water based aliphatic polyurethane.
  - b. Formulation Description: High UV stability, stain and mar resistant. LEED compliant low V.O.C.
  - c. Application Method: Finish roller, dip into coating and back roll.
    - 1) Number of coats: (1) one
  - d. Aggregates: Optional if needed verify inclusion of slip-retardant aggregates in sealer coat.

D. System Characteristics:

1. Color and Pattern: As indicated in Section 09 06 00, SCHEDULE OF FINISHES.
2. Integral cove base: 1-inch (25.4 mm) radius epoxy mortar cove keyed into concrete substrate. Verify cove base installation with manufacturer's system.
3. Overall System Thickness: Verify thickness as systems vary by manufacturer; between 3/16 inch (4.76 mm) and 1/4 inch (6.35 mm)
4. Finish: Textured anti-slip resistant to meet or exceed 0.06 dry; 0.08 wet.

E. Physical Properties:

1. Physical Properties of flooring system when tested as follows:

Property	Test	Value
Compressive Strength	ASTM C579	7,500 psi after 7 days
Volatile Organic Compound Limits (V.O.C.)	EPA & LEED	Below 100 g/l
Tensile Strength	ASTM C307	1,750 psi
Flexural Modulus of Elasticity	ASTM C580	2,800 psi
Water Absorption	ASTM C413	0.1%
Slip Resistance Index	ASTM F1679	0.81 dry and 0.56 wet. Minimal levels
Impact Resistance	ASTM D4226	> 160 in. lbs
Abrasion Resistance	ASTM D4060 Cs-17 wheel, 1000 cycles	0.06 gm maximum weight loss
Thermal Coefficient of Linear Expansion	ASTM C531	$1.3 \times 10^{-5}$ mm/ °C mm
Hardness Shore D	ASTM D2240	85 to 90
Bond Strength	ASTM D7234	>300 psi 100% concrete failure
Chemical Resistance of the following:	ASTM D1380	No Effect
Betadyne stain resistance		
Acetic acid	5 percent	
Ammonium hydroxide	10 percent	
Citric Acid	50 percent	
Fatty acid Motor Oil, 20W		
Hydrochloric acid		
Salt water	10 percent	
Sodium Hydroxide	10 percent	
Sulfuric acid	10 percent	
Trisodium phosphate	5 percent	
Urine		
Feces		
Hydrogen peroxide	28 percent	
Distilled Water		
Sodium Hypochloride	5.28 percent	

## **2.2 BASE CAP STRIP**

- A. Aluminum, Extruded: ASTM B221, Alloy 6063-T6.
- B. Shape for 5 mm (3/16 inch) depth of base material, "J" configuration.
- C. Finish:
  - 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
  - 2. Aluminum: NAAMM Amp 500:
    - a. Clear anodic coating, AA-C22A41 chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.

## **2.3 SUPPLEMENTAL MATERIALS**

- A. Textured Top Coat: Type recommended or produced by manufacturer of seamless resinous flooring system, slip-resistance type and profile of for desired final finish.
- B. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service or joint conditioned indicated.
- C. Waterproof Membrane: Type recommended or produced by manufacturer of resinous floor coatings for type of service and conditions as indicated in Drawings and/or specified.
- D. Provide a chemical-resistant epoxy novolac top coat capable of resisting sustained temperatures up to //120°C (250°F).
- E. Crack Isolation Membrane: Type recommended or produced by manufacturer of resinous flooring for conditions as indicated in Drawings and/or specified.
- F. Anti-Microbial Additive: Incorporate anti-microbial chemical additive to prevent growth of most bacteria, algae, fungi, mold, mildew, yeast, etc.
- G. Patching and Fill Material: Resinous product of or approved by resinous coating manufacturer for application indicated. Resinous-based materials only. Cementitious or single component products are not acceptable.

### **PART 3 - EXECUTION**

#### **3.1 INSPECTION**

- A. Examine the areas and conditions where monolithic resinous flooring system with integral base is to be installed with the VA Resident Engineer.
- B. Moisture Vapor Emission Testing: Perform moisture vapor transmission testing in accordance with ASTM F1869, to determine the MVER of the substrate prior to commencement of the work. See Section 3.4, Paragraph B.3.

#### **3.2 PROJECT CONDITIONS**

- A. Maintain temperature of rooms (air and surface) where work occurs, between 70 and 90 degrees F (21 and 32 degrees C) for at least 48 hours, before, during, and 24 hours after installation. Maintain temperature at least 70 degrees F (21 degrees C) during cure period.
- B. Maintain relative humidity less than 75 percent.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.
- D. Maintain proper ventilation of the area during application and curing time period.
  - 1. Comply with infection control measures of the VA Medical Center.

#### **3.3 INSTALLATION REQUIREMENTS**

- A. The manufacturer's instructions for application and installation shall be reviewed with the VA Resident Engineer for the seamless resinous flooring system with integral cove base.
- B. Substrate shall be approved by manufacturer's technical representative.

#### **3.4 PREPARATION**

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
  - 1. Prepare concrete substrates as follows:
    - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.

- b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
- 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
- 3. Verify that concrete substrates are dry.
  - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of **5 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)** in 24 hours.
  - b. MVT threshold for monolithic resinous, non-climatic flooring shall not exceed 5 lbs/1000 square feet (0.0001437 kPa) in a 24-hour period. MVT threshold for monolithic resinous climatic flooring shall not exceed 6 lbs/1000 square feet (0.0002155 kPa) over a 24-hour period.
  - c. When MVT emission exceeds this limit, apply manufacturer's recommended vapor control primer or other corrective measures as recommended by manufacturer prior to application of flooring or membrane systems.
  - d. Perform in-situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75-80 percent.
  - e. Provide a written report showing test placement and results.
- 4. Verify that concrete substrates have neutral Ph, and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Treat control joints and other non-moving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for flooring manufacturer's recommended joint fill material, and concrete crack treatment.

F. Prepare wall to receive integral cove base:

1. Verify wall material is acceptable for resinous flooring application; if not, install material (e.g. cement board) to receive base.
2. Fill voids in wall surface to receive base, install undercoats (e.g. water proofing membrane, and/or crack isolation membrane) as recommended by resinous flooring manufacturer.
3. Install base prior to flooring if required by resinous flooring manufacturer.
4. Grind, cut or sand protrusions to receive base application.

**3.5 APPLICATION**

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum inter-coat adhesion.
  2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
  3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
    - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Apply Primer: over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply cove base: Trowel to wall surfaces at a 1-inch radius, before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, and troweling, sanding, and top coating of cove base. Round internal and external corners.
- D. Trowel mortar base: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using a specially designed screed box adjusted to manufacturer's recommended height. Metal trowel hand or plastic blade power trowel, single mortar coat in thickness indicated for flooring system. Pre-fill or grout to

fill substrate voids. When cured, scrape or lightly stone mortar base to remove left unbounded material.

- E. Grout coat: Mix and roller apply the grout coats with strict adherence to manufacturer's installation procedures and coverage rates. (2) Two grout coatings to ensure uniform coverage with wet-on-wet application.
- F. Topcoat: Mix and roller apply the topcoat(s) with strict adherence to manufacturer's installation procedures and coverage rates.

### **3.6 TOLERANCE**

- A. From line of plane: Maximum 1/8 inch (3.18 mm) in total distance of flooring and base.
- B. From radius of cove: Maximum of 1/8 inch (3.18 mm) plus or 1/16-inch (1.59 mm) minus.

### **3.7 CURING, PROTECTION AND CLEANING**

- A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process.
- B. Close area of application for a minimum of 24 hours.
- C. Protect resinous flooring materials from damage and wear during construction operation.
  - 1. Cover flooring with kraft type paper.
  - 2. Optional 6 mm (1/4 inch) thick hardboard, plywood or particle board where area is in foot or vehicle traffic pattern, rolling or fixed scaffolding and overhead work occurs.
- D. Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

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**SECTION 09 72 00**  
**HYGIENIC VINYL WALLCOVERING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies hygienic vinyl wall covering of 100% pure vinyl extruded, homogenous semi-rigid PVCu sheet.

**1.2 RELATED WORK**

- A. Color, pattern, type and location of hygienic vinyl wall coverings:  
Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Samples:
1. Hygienic vinyl wall covering, each type and pattern as specified in Section 09 06 00, SCHEDULE FOR FINISHES, size, 300 mm x 300 mm (12 inches x 12 inches), each color.
  2. Molding, each type.
- C. Manufacturer's Literature and Data:
1. Primer and adhesive.
  2. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
  3. Complete published manufacturer's instructions for installation of hygienic vinyl wall covering.
  4. Complete published manufacturer's maintenance instructions for each type of hygienic vinyl wall covering.
- D. Certificate: Flame spread and smoke density factors.
- E. Drawings: Submit elevation layout diagrams indicating the location of each panel and joining method.

**1.4 QUALITY ASSURANCE**

- A. Before proceeding with the work under this Section, and in coordination with other trades, finish one complete space of each type (color and pattern) of hygienic vinyl wall covering showing selected colors, textures, materials and workmanship.
- B. After approval, the sample spaces or items shall serve as a standard for similar work throughout the building.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- A. Deliver wall coverings, sealers, adhesives and accessories specified, to the job site in sealed, labeled containers, each bearing the manufacturer's names, brand names and color designations.
- B. Store wall covering materials laid flat, not upright, in a dry area with heat maintained at 16 °C (60 °F) minimum with humidity normal to the space or area where wall covering is to be installed.

### **1.6 JOB CONDITIONS**

- A. Temperatures:
  - 1. Do not start wall covering work until surfaces and materials have been maintained at 16 °C (60 °F) minimum, or higher if recommended by hygienic wall covering manufacturer, for three days before work begins.
  - 2. Maintain minimum temperature of 16 °C (60 °F) during the work and until primers and adhesives have fully dried or cured.
- B. Ventilation: Provide continuous ventilation as required to rid the spaces in which the hygienic vinyl wall coverings are being installed of volatile compounds given off by the wall coverings, sealers and adhesives, and as recommended by the product manufacturer for full drying or curing.
- C. Protect other surfaces from damage which may be caused by this work. Provide drop cloths, shields and protective equipment to prevent primers, adhesives or hygienic vinyl wall coverings from fouling adjacent surfaces and in particular, storage and preparation areas.
- D. Store flammable rubbish, waste, cloths and materials which may constitute a fire hazard, in closed metal containers. Daily remove and properly dispose of flammable wastes from the site.

### **1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only.
- B. Federal Specifications (Fed. Spec):
  - A-A-1936A.....Adhesive, Contact, Neoprene Rubber
- C. National Association of Architectural Metal Manufacturers (NAAMM):
  - AMP 500 Series.....Metal Finishes Manual

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

E84-10.....Surface Burning Characteristics of Building  
Materials

**PART 2 - PRODUCTS**

**2.1 HYGENIC VINYL WALL COVERING**

- A. 100% pure vinyl, extruded, homogenous semi-rigid PVCu sheet, containing no plasticizers or fillers, and incorporating a bacteriostat in the material to give the exposed surface excellent antibacterial activity and protection against fungal activity.
- B. Flame spread rating of 0-20 and smoke development rating of 0-25 when tested in accordance with ASTM E84.
- C. Mildew-Resistant.

**2.2 PRIMERS AND ADHESIVES**

- A. Mildew-resistant type (acrylic or polyurethane-based) as recommended by the hygienic vinyl wall covering manufacturer for use on substrates to receive the hygienic vinyl wall covering.

**2.3 ACCESSORIES**

- A. Vinyl Welding Rods, Joint Strips, Transition Strips, Starting and Edge Trims, and Stainless Steel Accessories: Types and sizes as recommended by the hygienic vinyl wall covering manufacturer.

**PART 3 - EXECUTION**

**3.1 SURFACE CONDITIONS**

- 1. Do not apply hygienic vinyl wall covering to rough surfaces, or to surfaces which have stains that will bleed through the wall covering. Fill cracks and holes and sand rough spots smooth. Masonry and concrete walls shall have flush joints. Coat these walls with appropriate substrate preparation as recommended by the hygienic vinyl wall covering manufacturer.
- 2. Surfaces to receive hygienic vinyl wall covering shall be thoroughly dry. Test moisture content of plaster, concrete, and masonry walls with an electric moisture meter. The moisture shall not be more than 5 percent.
- 3. Prime surfaces of walls as required by the manufacturer's published instructions. Primer shall be completely dry before adhesive is applied.

4. Existing surfaces should be clean; free of mildew or loose or flakey paint; and, smooth before the application of primer, and adhesive.

### **3.2 INSTALLATION**

- A. Install according to manufacturer's published installation instructions. Clean up adhesive spillage with recommended cleaners. Install edge guards, trims and accessories where either shown or as required by the manufacturer.

### **3.3 CLEAN-UP**

- A. Upon completion of work, leave hygienic vinyl wall covering free of dirt or soil.

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**SECTION 09 91 00**  
**PAINTING**

**PART 1-GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

**1.2 RELATED WORK**

- A. Shop-prime painting of steel and ferrous metals: Division 08 - OPENINGS, Division 10 - SPECIALTIES, Division 13 - SPECIAL CONSTRUCTION, Division 14 - CONVEYING EQUIPMENT, Division 21 - FIRE SUPPRESSION, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY sections.
- B. Type of Finish, Color, and Gloss Level of Finish Coat: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Manufacturer's Literature and Data:  
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.

C. Sample Panels:

1. After painters' materials have been approved and before work is started, submit sample panels showing each type of finish and color specified.
2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
3. Attach labels to panel stating the following:
  - a. Federal Specification Number or manufacturers name and product number of paints used.
  - b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
  - c. Product type and color.
  - d. Name of project.
4. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

D. Sample of identity markers if used.

E. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. High temperature aluminum paint.
3. Epoxy coating.
4. Intumescent clear coating or fire-retardant paint.

**1.4 DELIVERY AND STORAGE**

A. Deliver materials to site in manufacturers' sealed containers marked to show following:

1. Name of manufacturer.
2. Product type.
3. Batch number.
4. Instructions for use.
5. Safety precautions.

B. In addition to manufacturer's label, provide a label legibly printed as following:

1. Federal Specification Number, where applicable, and name of material.
2. Surface upon which material is to be applied.
3. If paint or other coating, state coat types; prime, body or finish.

- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

#### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
  - ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
  - ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. American National Standards Institute (ANSI):
  - A13.1-07.....Scheme for the Identification of Piping Systems
- D. American Society for Testing and Materials (ASTM):
  - D260-86.....Boiled Linseed Oil
- E. Commercial Item Description (CID):
  - A-A-1555.....Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)
  - A-A-3120.....Paint, For Swimming Pools (RF) (cancelled)
- F. Federal Specifications (Fed Spec):
  - TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)
- G. Master Painters Institute (MPI):
  - No. 1-12.....Aluminum Paint (AP)
  - No. 4-12.....Interior/ Exterior Latex Block Filler
  - No. 5-12.....Exterior Alkyd Wood Primer
  - No. 7-12.....Exterior Oil Wood Primer
  - No. 8-12.....Exterior Alkyd, Flat MPI Gloss Level 1 (EO)
  - No. 9-12.....Exterior Alkyd Enamel MPI Gloss Level 6 (EO)
  - No. 10-12.....Exterior Latex, Flat (AE)
  - No. 11-12.....Exterior Latex, Semi-Gloss (AE)
  - No. 18-12.....Organic Zinc Rich Primer

- No. 22-12.....Aluminum Paint, High Heat (up to 590° - 1100F)  
(HR)
- No. 26-12.....Cementitious Galvanized Metal Primer
- No. 27-12.....Exterior / Interior Alkyd Floor Enamel, Gloss (FE)
- No. 31-12.....Polyurethane, Moisture Cured, Clear Gloss (PV)
- No. 36-12.....Knot Sealer
- No. 43-12.....Interior Satin Latex, MPI Gloss Level 4
- No. 44-12.....Interior Low Sheen Latex, MPI Gloss Level 2
- No. 45-12.....Interior Primer Sealer
- No. 46-12.....Interior Enamel Undercoat
- No. 47-12.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)
- No. 48-12.....Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)
- No. 49-12.....Interior Alkyd, Flat, MPI Gloss Level 1 (AK)
- No. 50-12.....Interior Latex Primer Sealer
- No. 51-12.....Interior Alkyd, Eggshell, MPI Gloss Level 3
- No. 52-12.....Interior Latex, MPI Gloss Level 3 (LE)
- No. 53-12.....Interior Latex, Flat, MPI Gloss Level 1 (LE)
- No. 54-12.....Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
- No. 59-12.....Interior/Exterior Alkyd Porch & Floor Enamel, Low  
Gloss (FE)
- No. 60-12.....Interior/Exterior Latex Porch & Floor Paint, Low  
Gloss
- No. 66-12.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC  
Approved) (FC)
- No. 67-12.....Interior Latex Fire Retardant, Top-Coat (ULC  
Approved) (FR)
- No. 68-12.....Interior/ Exterior Latex Porch & Floor Paint,  
Gloss
- No. 71-12.....Polyurethane, Moisture Cured, Clear, Flat (PV)
- No. 74-12.....Interior Alkyd Varnish, Semi-Gloss
- No. 77-12.....Epoxy Cold Cured, Gloss (EC)
- No. 79-12.....Marine Alkyd Metal Primer
- No. 90-12.....Interior Wood Stain, Semi-Transparent (WS)
- No. 91-12.....Wood Filler Paste
- No. 94-12.....Exterior Alkyd, Semi-Gloss (EO)
- No. 95-12.....Fast Drying Metal Primer
- No. 98-12.....High Build Epoxy Coating



- No. 101-12.....Epoxy Anti-Corrosive Metal Primer  
No. 108-12.....High Build Epoxy Coating, Low Gloss (EC)  
No. 114-12.....Interior Latex, Gloss (LE) and (LG)  
No. 119-12.....Exterior Latex, High Gloss (acrylic) (AE)  
No. 135-12.....Non-Cementitious Galvanized Primer  
No. 138-12.....Interior High Performance Latex, MPI Gloss Level 2  
(LF)  
No. 139-12.....Interior High Performance Latex, MPI Gloss Level 3  
(LL)  
No. 140-12.....Interior High Performance Latex, MPI Gloss Level 4  
No. 141-12.....Interior High Performance Latex (SG) MPI Gloss  
Level 5
- H. Steel Structures Painting Council (SSPC):  
SSPC SP 1-04 (R2004)....Solvent Cleaning  
SSPC SP 2-04 (R2004)....Hand Tool Cleaning  
SSPC SP 3-04 (R2004)....Power Tool Cleaning

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Cementitious Paint (CEP): TT-P-1411A [Paint, Copolymer-Resin, Cementitious (CEP)], Type 1 for exterior use, Type II for interior use.  
C. Identity markers options:  
1. Pressure-sensitive vinyl markers.  
2. Snap-on coil plastic markers.  
D. Aluminum Paint (AP): MPI 1.  
E. Interior/Exterior Latex Block Filler: MPI 4.  
F. Exterior Alkyd Wood Primer: MPI 5.  
G. Exterior Oil Wood Primer: MPI 7.  
H. Exterior Alkyd, Flat (EO): MPI 8.  
I. Exterior Alkyd Enamel (EO): MPI 9.  
J. Exterior Latex, Flat (AE): MPI 10.  
K. Exterior Latex, Semi-Gloss (AE): MPI 11.  
L. Organic Zinc-rich Coating (HR): MPI 22.  
M. High Heat-Resistant Coating (HR): MPI 22.  
N. Cementitious Galvanized Metal Primer: MPI 26.  
O. Exterior/ interior Alkyd Floor Enamel, Gloss (FE): MPI 27.  
P. Interior Satin Latex: MPI 43.

- Q. Interior Low Sheen Latex: MPI 44.
- R. Interior Primer Sealer: MPI 45.
- S. Interior Enamel Undercoat: MPI 47.
- T. Interior Alkyd, Semi-Gloss (AK): MPI 47.
- U. Interior Alkyd, Gloss (AK): MPI 49.
- V. Interior Latex Primer Sealer: MPI 50.
- W. Interior Alkyd, Eggshell: MPI 51
- X. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.
- Y. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.
- Z. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.
- AA. Interior / Exterior Alkyd Porch & Floor Enamel, Low Gloss (FE): MPI 59.
- BB. Interior/ Exterior Latex Porch & Floor Paint, Low Gloss: MPI 60.
- CC. Interior Alkyd Fire-Retardant, Clear Top-Coat (ULC Approved) (FC): MPI 66.
- DD. Interior Latex Fire-Retardant, Top-Coat (ULC Approved) (FR): MPI 67.
- EE. Interior/ Exterior Latex Porch & Floor Paint, gloss: MPI 68.
- FF. Epoxy Cold Cured, Gloss (EC): MPI 77.
- GG. Marine Alkyd Metal primer: MPI 79.
- HH. Exterior Alkyd, Semi-Gloss (EO): MPI 94.
- II. Fast-Drying Metal Primer: MPI 95.
- JJ. High-Build Epoxy Coating: MPI 98.
- KK. Epoxy Anti-Corrosive Metal Primer: MPI 101.
- LL. High Build Epoxy Marine Coating (EC): MPI 108.
- MM. Interior latex, Gloss (LE) and (LG): MPI 114.
- NN. Exterior Latex, High Gloss (acrylic) (AE): MPI 119.
- OO. Waterborne Galvanized Primer: MPI 134.
- PP. Non-Cementitious Galvanized Primer: MPI 135.
- QQ. Interior High Performance Latex, MPI Gloss Level 2(LF): MPI 138.
- RR. Interior High Performance Latex, MPI Gloss Level 3 (LL): MPI 139.
- SS. Interior High Performance Latex, MPI Gloss Level 4: MPI 140.
- TT. Interior High Performance Latex (SG), MPI Gloss Level 5: MPI 141.

## **2.2 PAINT PROPERTIES**

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

## **2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE**

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
  - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
  - 2. Lead-Based Paint:
    - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
    - b. Regulations concerning prohibition against use of lead-based paint in federal and federally-assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
    - c. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
  - 3. Asbestos: Materials shall not contain asbestos.
  - 4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
  - 5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
  - 6. Use high performance acrylic paints in place of alkyd paints, where possible.
  - 7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

### **PART 3 - EXECUTION**

#### **3.1 JOB CONDITIONS**

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
  - 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
  - 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.
- B. Atmospheric and Surface Conditions:
  - 1. Do not apply coating when air or substrate conditions are:
    - a. Less than 3 degrees C (5 degrees F) above dew point.
    - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
  - 2. Maintain interior temperatures until paint dries hard.
  - 3. Do no exterior painting when it is windy and dusty.
  - 4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
  - 5. Apply only on clean, dry and frost free surfaces except as follows:
    - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
    - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.

#### **3.2 SURFACE PREPARATION**

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
  - 1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
  - 2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.

3. See other sections of specifications for specified surface conditions and prime coat.
4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.

C. Ferrous Metals:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
  - a. This includes flat head countersunk screws used for permanent anchors.
  - b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot-prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot-prime to produce smooth finish coat.
5. Spot-prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

D. Zinc-Coated (Galvanized) Metal, Aluminum, Copper and Copper Alloy

Surfaces Specified to be Painted:

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non- Cementitious Galvanized Primer) depending on finish coat compatibility.

E. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

**3.3 PAINT PREPARATION**

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

### **3.4 APPLICATION**

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.
- G. Do not spray paint in existing occupied spaces unless approved by Resident Engineer, except in spaces sealed from existing occupied spaces.
  - 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
  - 2. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.
- H. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

### **3.5 PRIME PAINTING**

- A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot-prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.

E. Metals (except boilers, incinerator stacks, and engine exhaust pipes):

1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer). Use MPI 101 (Cold Curing Epoxy Primer) where MPI 77 (Epoxy Cold Cured, Gloss (EC)) finish is specified.
2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer).
3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
4. Terne Metal: MPI 79 (Marine Alkyd Metal Primer).
5. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
6. Machinery not factory-finished: MPI 9 (Exterior Alkyd Enamel (EO)).
7. Asphalt-coated metal: MPI 1 (Aluminum Paint (AP)).
8. Metal over 94 degrees C. (200 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating (HR)).

F. Gypsum Board:

1. Surfaces scheduled to have MPI 53 (Interior Latex, Flat), MPI Gloss Level 1 (LE)); MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)); MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)); or MPI 114 (Interior Latex, Gloss (LE) and (LG)) finishes: Use MPI 53 (Interior Latex, MPI Gloss Level 3 (LE)); MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)); MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)) respectively.
2. Use MPI 101 (Cold Curing Epoxy Primer) for surfaces scheduled to receive MPI 77 (Epoxy Cold Cured, Gloss (EC)) finish.

G. Concrete Masonry Units (except glazed or integrally colored and decorative units):

1. MPI 4 (Block Filler) on interior surfaces.
2. Prime exterior surface as specified for exterior finishes.

**3.6 INTERIOR FINISHES**

A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section 09 06 00, SCHEDULE FOR FINISHES.

B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.



3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:

- a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise.
- b. Two coats of MPI 51 (Interior Alkyd, Eggshell (AK)).
- c. One coat of MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) on exposed interior surfaces of alkyd-amine enamel prime finished windows.
- d. Machinery: One coat MPI 9 (Exterior Alkyd Enamel (EO)).
- e. Asphalt-Coated Metal: One coat MPI 1 (Aluminum Paint (AP)).
- f. Ferrous Metal over 94 degrees K (200 degrees F): Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One coat MPI 22 (High Heat Resistant Coating (HR)).

C. Gypsum Board:

1. One coat of MPI 45 (Interior Primer Sealer) plus one coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3 (LL)).
2. Two coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2 (LF)).
3. One coat of MPI 45 (Interior Primer Sealer) plus one coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)).
4. One coat of MPI 45 (Interior Primer Sealer) plus one coat of MPI 48 (Interior Alkyd Gloss (AK)).

**3.7 REFINISHING EXISTING PAINTED SURFACES**

- A. Clean, patch and repair existing surfaces as specified under surface preparation.
- B. Remove and reinstall items as specified under surface preparation.
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- G. Sand or dull glossy surfaces prior to painting.

- H. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

### **3.8 PAINT COLORS**

- A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD-PAINTING SCHEDULE.
- C. Coat Colors:
1. Color of priming coat: Lighter than body coat.
  2. Color of body coat: Lighter than finish coat.
  3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
1. Paint to match color of casework where casework has a paint finish.
  2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

### **3.9 MECHANICAL AND ELECTRICAL WORK FIELD-PAINTING SCHEDULE**

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified under paragraph H, colors.
- C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY.
- D. Paint after tests have been completed.
- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.
- G. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.

H. Color:

1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:
  - a. White .....Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
  - b. Gray: .....Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
  - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
  - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
  - e. Federal Safety Orange: .Entire lengths of electrical conduits containing feeders 600 volts or more.
  - f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.

I. Apply paint systems on properly prepared and primed surface as follows:

1. Interior Locations:
  - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:
    - 1) Metal under 94 degrees C (200 degrees F) of items such as bare piping, fittings, hangers and supports.
    - 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
    - 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory-finished.

- b. Apply two coats of MPI 22 (High Heat Resistant Coating (HR)) to ferrous metal surface over 94 degrees K (200 degrees F) of following items:
    - 1) Garbage and trash incinerator.
    - 2) Medical waste incinerator.
    - 3) Exterior of boilers and ferrous metal in connection with boiler settings including supporting members, doors and door frames and fuel oil burning equipment.
    - 4) Steam line flanges, bare pipe, fittings, valves, hangers and supports over 94 degrees K (200 degrees F).
    - 5) Engine generator exhaust piping and muffler.
  - c. Paint electrical conduits containing cables rated 600 volts or more using two coats of MPI 9 (Exterior Alkyd Enamel (EO)) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.
2. Other exposed locations:
- a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two coats of MPI 1 (Aluminum Paint (AP)).
  - b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 11 (Exterior Latex Semi-Gloss (AE)).

### **3.10 BUILDING AND STRUCTURAL WORK FIELD PAINTING**

- A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11 B.
  - 1. Painting and finishing of new and existing work, including colors and gloss of finish selected, is specified in Finish Schedule, Section 09 06 00, SCHEDULE FOR FINISHES.
  - 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
  - 3. Painting of ferrous metal and galvanized metal.
  - 4. Identity painting and safety painting.

B. Building and Structural Work not Painted:

1. Prefinished items:

- a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
- b. Factory-finished equipment and pre-engineered metal building components such as metal roof and wall panels.

2. Finished surfaces:

- a. Hardware except ferrous metal.
- b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
- c. Signs, fixtures, and other similar items integrally finished.

3. Concealed surfaces:

- a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
- b. Inside walls or other spaces behind access doors or panels.
- c. Surfaces concealed behind permanently-installed casework and equipment.

4. Moving and operating parts:

- a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
- b. Tracks for overhead or coiling doors, shutters, and grilles.

5. Labels:

- a. Code required label, such as Underwriters Laboratories Inc., Inchcape Testing Services, Inc., or Factory Mutual Research Corporation.
- b. Identification plates, instruction plates, performance rating, and nomenclature.

6. Galvanized metal:

- a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
- b. Gas Storage Racks.
- c. Except where specifically specified to be painted.

7. Metal safety treads and nosings.

8. Gaskets.

9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
10. Face brick.
11. Structural steel encased in concrete, masonry, or other enclosure.
12. Structural steel to receive sprayed-on fire proofing.
13. Ceilings, walls, columns in interstitial spaces.
14. Ceilings, walls, and columns in pipe basements.

### **3.11 IDENTITY PAINTING SCHEDULE**

- A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.
  1. Legend may be identified using 2.1 G options or by stencil applications.
  2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12 000 mm (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
  3. Locate Legends clearly visible from operating position.
  4. Use arrow to indicate direction of flow.
  5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
    - a. High Pressure - 414 kPa (60 psig) and above.
    - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
    - c. Low Pressure - 103 kPa (14 psig) and below.
    - d. Add Fuel oil grade numbers.

6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND BBREVIATIONS
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret
Shop Compressed Air		Yellow	Black	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Yellow	Black	H.P. _____*
High Pressure Condensate Return		Yellow	Black	H.P. Ret _____*
Medium Pressure Steam		Yellow	Black	M. P. Stm _____*
Medium Pressure Condensate Return		Yellow	Black	M.P. Ret _____*
Low Pressure Steam		Yellow	Black	L.P. Stm _____*
Low Pressure Condensate Return		Yellow	Black	L.P. Ret _____*
High Temperature Water Supply		Yellow	Black	H. Temp Wtr Sup
High Temperature Water Return		Yellow	Black	H. Temp Wtr Ret
Hot Water Heating Supply		Yellow	Black	H. W. Htg Sup
Hot Water Heating Return		Yellow	Black	H. W. Htg Ret
Gravity Condensate Return		Yellow	Black	Gravity Cond Ret
Pumped Condensate Return		Yellow	Black	Pumped Cond Ret
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret
Fuel Oil - Grade		Brown	White	Fuel Oil-Grade ____*
(Diesel Fuel included under Fuel Oil)				
Boiler Water Sampling		Yellow	Black	Sample
Chemical Feed		Yellow	Black	Chem Feed
Continuous Blow-Down		Yellow	Black	Cont. B D
Pumped Condensate		Black		Pump Cond
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line		Yellow	Black	Vent
Alkali		Yellow	Black	Alk
Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				

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Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Yellow	Black	Acid Waste
Vent		Yellow	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler		Red	White	Auto Spr
Standpipe		Red	White	Stand
Sprinkler		Red	White	Drain

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6100 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, // 5000 // 15000 // 25000 //.
8. See Sections for methods of identification, legends, and abbreviations of the following:
  - a. Conduits containing high voltage feeders over 600 volts: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS / Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.



B. Fire and Smoke Partitions:

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
3. Locate not more than 6100 mm (20 feet) on center on corridor sides of partitions, and with a least one message per room on room side of partition.
4. Use semi-gloss paint of color that contrasts with color of substrate.

C. Identify columns in pipe basements and interstitial space:

1. Apply stenciled number and letters to correspond with grid numbering and lettering shown.
2. Paint numbers and letters 100 mm (4 inches) high, locate 450 mm (18 inches) below overhead structural slab.
3. Apply on four sides of interior columns and on inside face only of exterior wall columns.
4. Color:
  - a. Use black on concrete columns.
  - b. Use white or contrasting color on steel columns.

**3.12 PROTECTION, CLEAN-UP AND TOUCH-UP**

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

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## APPENDIX

Coordinate the following abbreviations used in Section 09 91 00, PAINTING, with other Sections, especially Section 09 06 00, SCHEDULE FOR FINISHES and other COATING SECTIONS listed. Use the same abbreviation and terms consistently.

Paint or coating    Abbreviation

Acrylic Emulsion    AE (MPI 10 - flat/MPI 11 - semi-gloss/MPI 119 - gloss)

Alkyd Flat    Ak (MPI 49)

Alkyd Gloss Enamel    G (MPI 48)

Alkyd Semi-gloss Enamel SG (MPI 47)

Aluminum Paint    AP (MPI 1)

Cementitious Paint    CEP (TT-P-1411)

Exterior Latex    EL??(MPI 10 / 11 / 119)??

Exterior Oil    EO (MPI 9 - gloss/MPI 8 - flat/MPI 94 - semi-gloss)

Epoxy Coating    EC (MPI 77 - walls, floors/MPI 108 - CMU, concrete)

Fire Retardant Paint    FR (MPI 67)

Fire Retardant Coating (Clear)    FC (MPI 66, intumescent type)

Floor Enamel    FE (MPI 27 - gloss/MPI 59 - eggshell)

Heat Resistant Paint    HR (MPI 22)

Latex Emulsion    LE (MPI 53, flat/MPI 52, eggshell/MPI 54, semi-gloss/MPI 114, gloss Level 6

Latex Flat    LF (MPI 138)

Latex Gloss LG (MPI 114)

Latex Semi-gloss SG (MPI 141)

Latex Low Luster LL (MPI 139)

Plastic Floor Coating    PL

Polyurethane Varnish    PV (MPI 31 - gloss/MPI 71 - flat)

Rubber Paint    RF (CID-A-A-3120 - Paint for Swimming Pools (RF)).

Water Paint, Cement    WPC (CID-A-A-1555 - Water Paint, Powder).

Wood Stain    WS (MPI 90)

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**SECTION 10 26 00**  
**WALL AND DOOR PROTECTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies wall guards (crash rails or bumper guards), handrail/wall guard combinations, corner guards and door/door frame protectors.

**1.2 RELATED WORK**

- A. Armor plates and kick plates not specified in this section: Section 08 71 00, DOOR HARDWARE.
- B. Color and texture of aluminum and resilient material: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Shop Drawings: Show design and installation details.
- C. Manufacturer's Literature and Data:
  - 1. Handrail/Wall Guard Combinations.
  - 2. Wall Guards.
  - 3. Corner Guards.
  - 4. Door/Door Frame Protectors.
- D. Test Report: Showing that resilient material complies with specified fire and safety code requirements.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.
- B. Protect from damage from handling and construction operations before, during and after installation.
- C. Store in a dry environment of approximately 21° C (70 degrees F) for at least 48 hours prior to installation.

## 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
- A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - D256-06.....Impact Resistance of Plastics
  - D635-06.....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
  - E84-09.....Surface Burning Characteristics of Building Materials
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500-06.....Metal Finishes Manual
- D. National Fire Protection Association (NFPA):
- 80-10.....Standard for Fire Doors and Windows
- E. Society of American Automotive Engineers (SAE):
- J 1545-05.....Instrumental Color Difference Measurement for Exterior Finishes.
- F. Underwriters Laboratories Inc. (UL):
- Annual Issue.....Building Materials Directory

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Stainless Steel: ASTM A167, Type 302B.
- B. Aluminum Extruded: ASTM B221, Alloy 6063, Temper T5 or T6.
- C. Resilient Material:
1. Extruded and injection molded acrylic vinyl or extruded polyvinyl chloride meeting following requirements:
    - a. Minimum impact resistance of 1197 ps (25 ft lbs per sq.ft) when tested in accordance with ASTM D256 (Izod impact, ft.lbs. per inch notch).

- b. Class 1 fire rating when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less.
- c. Rated self-extinguishing when tested in accordance with ASTM D635.
- d. Material shall be labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
- e. Integral color with all colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.
- f. Same finish on exposed surfaces.

## **2.2 CORNER GUARDS**

- A. Resilient, Shock-Absorbing Corner Guards: Surface mounted type of 30 mm (1-1/4 inch radius, formed to profile shown).
  - 1. Snap-on corner guard formed from resilient material, minimum 2 mm (0.078-inch) thick, free floating on a continuous 1.6 mm (0.063-inch) thick extruded aluminum retainer. Provide appropriate mounting hardware, cushions and base plates as required.
  - 2. Provide factory-fabricated end closure caps at top and bottom of surface-mounted corner guards.
  - 3. Flush-mounted corner guards installed on any fire-rated wall shall maintain the fire rating of the wall. Provide fire test of proposed corner guard system to verify compliance.
    - a. Where insulating materials are an integral part of the corner guard system, the insulating materials shall be provided by the manufacturer of the corner guard system.
    - b. All exposed metal in fire-rated assemblies shall have a paintable finish.
- B. Stainless Steel Corner Guards: Fabricate of 1.6 mm (0.0625-inch) thick stainless steel. Form guards of dimensions and to contour shown.

## **2.3 WALL GUARDS AND HANDRAILS**

### **A. Resilient Wall Guards and Handrails:**

1. Handrail/Wall Guard Combination: Snap-on covers of resilient material, minimum 2 mm (0.078-inch) thick, shall be free-floated on a continuous, extruded aluminum retainer, minimum 1.8 mm (0.072-inch) thick, anchored to wall at maximum 760 mm (30 inches) on center.
2. Wall Guards (Crash Rails): Snap-on covers of resilient material, minimum 2.8 mm (0.110-inch) thick, shall be free-floated over 50 mm (two-inch) wide aluminum retainer clips, minimum 2.3 mm (0.090-inch) thick, anchored to wall at maximum 600 mm (24 inches) on center, supporting a continuous aluminum retainer, minimum 1.6 mm (0.062-inch) thick; or, shall be free-floated over a continuous extruded aluminum retainer, minimum 2.3 (0.090-inch) thick anchored to wall at maximum 600 mm (24 inches) on center.
3. Provide handrails and wall guards (crash rails) with prefabricated and closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories as required. End caps and corners shall be field-adjustable to assure close alignment with handrails and wall guards (crash rails). Screw or bolt closure caps to aluminum retainer.

### **B. Aluminum Wall Guards: Extruded aluminum, closed tubular bumper assembly mounted on wall brackets as shown.**

1. Provide wall bumper with factory-fabricated end closure caps, and inside and outside corner assemblies, concealed splice plates, and other accessories standard with the manufacturer.
2. Fabricate tubular wall guards from material with a nominal wall thickness of 6 mm (0.250-inch), form grooves for and provide two strips of continuous polyvinyl chloride cushion bumper inserts.
3. Fabricate adjustable wall brackets from aluminum having a nominal wall thickness of 5 mm (0.20-inch). Fasten bumper to brackets with 6 mm (1/4-inch) diameter aluminum or stainless steel bolts with locknuts.

### **C. Stainless Steel Wall Guards: Construct wall guard, including brackets, of minimum 4.75 mm (0.1875-inch) thick stainless steel to design shown.**



## **2.4 DOOR AND DOOR FRAME PROTECTION**

- A. Fabricate door and door frame protection items from vinyl acrylic or polyvinyl chloride resilient material, minimum 1.5 mm (0.060-inch) thick, for doors and 0.9 mm (0.035-inch) thick for door frames.
- B. Coordinate door and door frame protection material requirements with door and frame suppliers to ensure fit for all components, and colors as specified.
- C. Provide adhesive as recommended by resilient material manufacturer.

## **2.5 FASTENERS AND ANCHORS**

- A. Provide fasteners and anchors as required for each specific type of installation.
- B. Where type, size, spacing or method of fastening is not shown or specified, submit shop drawings showing proposed installation details.

## **2.6 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Aluminum:
  - 1. Exposed aluminum: AAC22A31 chemically-etched medium matte, with clear anodic coating, Class II Architectural, 0.4 mil thick.
  - 2. Concealed aluminum: Mill finish as fabricated, uniform in color and free from surface blemishes.
- C. Stainless Steel: NAAMM finish Number 4.
- D. Resilient Material: Embossed texture and color in accordance with SAE J 1545 and as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

## **PART 3 - INSTALLATION**

### **3.1 RESILIENT CORNER GUARDS**

- A. Install corner guards on walls in accordance with manufacturer's instructions.

### **3.2 STAINLESS STEEL CORNER GUARDS**

- A. Mount guards on external corners of interior walls, partitions and columns as shown.
- B. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile: Provide continuous 16 gage perforated, galvanized Z-shape steel anchors welded to back edges of corner guards and expansion-bolted to concrete or masonry with four 9.5 mm (3/8-inch) diameter bolts, spaced 400 mm (16 inches) on centers. Coat back surfaces of corner guards, where shown, with a non-flammable,

sound deadening material. Corner guards shall overlap finish plaster surfaces.

1. Where corner guards are installed on exposed structural glazed facing tile units or masonry wall, partitions or columns, anchor corner guards to existing walls with 6 mm (1/4-inch) oval head stainless steel countersunk expansion or toggle bolts. Grout spaces solid between guards and backing with Portland cement and sand mortar.
2. Where corner guards are installed on gypsum board, clean surface and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from around edge of guard and allow to cure undisturbed for 24 hours.

### **3.3 RESILIENT HANDRAIL, WALL GUARD COMBINATIONS, AND RESILIENT WALL GUARDS (CRASH RAIL)**

- A. Secure guards to walls with mounting cushions, brackets and fasteners in accordance with the manufacturer's details and instructions.

### **3.4 ALUMINUM WALL GUARDS**

- A. Secure brackets to walls with fasteners, spaced in accordance with the manufacturer's installation instructions.

### **3.5 STAINLESS STEEL WALL GUARDS**

- A. Space brackets at not more than three feet on centers and anchor to the wall in accordance with the manufacturer's installation instructions.

### **3.6 DOOR, DOOR FRAME PROTECTION**

- A. Surfaces to receive protection shall be clean, smooth and free of obstructions.
- B. Install protectors after frames are in place but preceding installation of doors in accordance with approved shop drawings and manufacturer's specific instructions.
- C. Apply with adhesive in controlled environment according to manufacturer's recommendations.
- D. Protection installed on fire-rated doors and frames shall be installed according to NFPA 80 and installation procedures listed in UL Building Materials Directory; or, equal listing by other approved independent testing laboratory establishing the procedures.

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**SECTION 14 21 00**  
**ELECTRIC TRACTION ELEVATORS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the engineering, furnishing and installation of complete and ready for operation electric traction elevator systems described herein and as indicated on the contract drawings.
- B. Items listed in the singular apply to each and every elevator in this specification except where noted.
- C. Existing Service Elevators No.'s S-7 and S-8, shall be overhead gearless traction type; with Direct Current (DC) microprocessor-based control system with regenerative drive; duplex selective collective automatic operation, and power operated two-speed center opening car and hoistway doors. Elevators shall have Class "A" loading.

**1.2 RELATED WORK**

- A. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES; SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.
- C. SECTION 09 06 00, SCHEDULE FOR FINISHES: As a master format for construction projects, to identify interior and exterior material finishes for type, texture, patterns, color and placement.
- D. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
- E. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
- F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- G. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.
- H. Section 26 51 00, INTERIOR LIGHTING: Fixture and ballast type for interior lighting.
- I. VA Barrier-Free Design Handbook (H-18-13)

### 1.3 QUALIFICATIONS

- A. Approval by the Contracting Officer is required for products and services of proposed manufacturers, suppliers and installers and shall be contingent upon submission by Contractor of certificates stating the following:
1. Elevator contractor is currently and regularly engaged in the installation of elevator equipment as one of his principal products.
  2. Elevator contractor shall have three years of successful experience, trained supervisory personnel, and facilities to install elevator equipment specified herein.
  3. The installers shall be Certified Elevator Mechanics with technical qualifications of at least five years of successful experience and Apprentices actively pursuing certified mechanic status. Certificates shall be submitted for all workers employed in this capacity.
  4. Elevator Contractor shall submit a list of two or more prior hospital installations where all the elevator equipment he proposes to furnish for this project functioned satisfactorily to serve varying hospital traffic and material handling demands. Provide a list of hospitals that have the equipment in operation for two years preceding the date of this specification. Provide the names and addresses of the Medical Centers and the names and telephone numbers of the Medical Center Administrators.
- B. Approval of Elevator Contractor's equipment will be contingent upon their identifying an elevator maintenance service provider that shall render services within two hours of receipt of notification, together with certification that the quantity and quality of replacement parts stock is sufficient to warranty continued operation of the elevator installation.
- C. Approval will not be given to elevator contractors and manufacturers who have established on prior projects (either government, municipal, or commercial), a record for unsatisfactory elevator installations, have failed to complete awarded contracts within the contract period, and do not have the requisite record of satisfactorily performing elevator installations of similar type and magnitude.
- D. All electric traction elevators shall be the product of the same manufacturer.

- E. The Contractor shall provide and install only those types of safety devices that have been subjected to tests witnessed and certified by an independent professional testing laboratory that is not a subsidiary of the firm that manufactures supplies or installs the equipment.
- F. Welding at the project site shall be made by welders and welding operators who have previously qualified by test as prescribed in American Welding Society Publications AWS D1.1 to perform the type of work required. Certificates shall be submitted for all workers employed in this capacity. A welding or hot work permit is required for each day and shall be obtained from the COR of safety department. Request permit one day in advance.
- G. Electrical work shall be performed by Licensed Electricians as requirements by NEC. Certificates shall be submitted for all workers employed in this capacity.

#### **1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification. Elevator installation shall meet the requirements of the latest editions published and adopted by the United States Department of Veterans Affairs on the date contract is signed.
- B. Federal Specifications (Fed. Spec.):
  - J-C-30B.....Cable and Wire, Electrical (Power, Fixed Installation)
  - W-C-596F.....Connector, Plug, Electrical; Connector, Receptacle, Electrical
  - W-F-406E.....Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible
  - HH-I-558C.....Insulation, Blankets, Thermal (Mineral Fiber, Industrial Type)
  - W-F-408E.....Fittings for Conduit, Metal, Rigid (Thick- Wall and Thin-wall (EMT) Type)
  - RR-W-410.....Wire Rope and Strand
  - TT-E-489J.....Enamel, Alkyd, Gloss, Low VOC Content
  - QQ-S-766 .....Steel, Stainless and Heat Resisting, Alloys, Plate, Sheet and Strip
- C. International Building Code (IBC)

- D. American Society of Mechanical Engineers (ASME):
  - A17.1-07.....Safety Code for Elevators
  - A17.2-07.....Inspectors Manual for Electric Elevators
- E. National Fire Protection Association:
  - NFPA 13-10.....Standard for the Installation of Sprinkler Systems
  - NFPA 70-11.....National Electrical Code (NEC)
  - NFPA 72-10.....National Fire Alarm and Signaling Code
  - NFPA 101-09.....Life Safety Code
  - NFPA 252-08.....Fire Test of Door Assemblies
- F. American Society for Testing and Materials (ASTM):
  - A1008/A1008M-10.....Steel, Sheet, Cold Rolled, Carbon, Structural,  
High-Strength Low-Alloy and High Strength Low-  
Alloy with Improved Formability
  - E1042-02(R2008).....Acoustically Absorptive Materials Applied by  
Trowel or Spray
- G. Society of Automotive Engineers, Inc. (SAE)
  - J517-10.....Hydraulic Hose, Standard
- H. Gauges:
  - For Sheet and Plate: U.S. Standard (USS)
  - For Wire: American Wire Gauge (AWG)
- I. American Welding Society (AWS):
  - D1.1-10.....Structured Welding Code Steel
- J. National Electrical Manufacturers Association (NEMA):
  - LD-3-05.....High-Pressure Decorative Laminates
- K. Underwriter's Laboratories (UL):
  - 486A-03.....Safety Wire Connectors for Copper Conductors
  - 797-07.....Safety Electrical Metallic Tubing
- L. Institute of Electrical and Electronic Engineers (IEEE)
- M. Regulatory Standards:
  - Uniform Federal Accessibility Standards
  - Americans with Disabilities Act

## 1.5 SUBMITTALS

- A. Submit in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Before execution of work, furnish information to evidence full compliance with contract requirements for proposed items. Such information shall include, as required: Manufacturer's Name, Trade Names, Model or Catalog Number, Nameplate Data (size, capacity, and rating) and corresponding specification reference (Federal or project specification number and paragraph). All submitted drawings and related elevator material shall be forwarded to the Contracting Officer.
- C. Shop Drawings (Existing Machine Room):
  - 1. Complete scaled and dimensioned layout in plan and section view showing the arrangement of equipment and all details of each and every elevator unit specified including:
    - a. Hoisting machines, controllers, power conversion devices, governors, and all other components located in machine room.
    - b. Car, existing counterweight, existing sheaves, existing supporting beams, existing guide rails, brackets, existing buffers, size of car platform, existing car frame members, and other components located in hoistway.
    - c. Rail bracket spacing and maximum vertical forces on guide rails in accordance with ASME A17.1 Section 2.23 and Section 8.4.8 for Existing Seismic Risk Zone 2 or greater.
    - d. Reactions at points of supports and buffer impact loads.
    - e. Weights of principal parts.
    - f. Top and bottom clearances and over travel of car and counterweight.
    - g. Location of shunt trip circuit breaker, switchboard panel, light switch, and feeder extension points in the machine room.
  - 2. Drawings of hoistway entrances and doors showing details of construction and method of fastening to the existing structural members of the building.
    - a. If drywall construction is used to enclose hoistway, submit details of interface fastenings between entrance frames and drywall.
    - b. Sill details including sill support.

D. Samples:

1. One each of stainless steel, 75 mm x 125 mm (3 in. x 5 in.).
2. One each of baked enamel, 75 mm x 125 mm (3 in. x 5 in.).
3. One each of color vinyl floor tile.
4. One each of protection pads, 75 mm x 125 mm (3 in. x 5 in.) if used.
5. One each car and hoistway Braille plate sample.
6. One each car and hall button sample.
7. One each car and hall lantern/position indicator sample.
8. One each wall and ceiling material finish sample.
9. One each car lighting sample.
10. Other samples of materials specified shall be submitted as specifically requested after submission of manufacturer's name. If additional samples are furnished pursuant to request and will be made as provided in Section 01 33 23 Shop Drawings, Product Data and Samples.

E. Name of manufacturer, type or style designation, and applicable data of the following equipment shall be shown on the elevator layouts:

1. Hoisting Machine (existing Westinghouse).
2. Hoisting Machine Motor, HP and RPM ratings, Voltage, Starting and Full Load Ampere, and Number of Phases (existing DC motor).
3. Controller
4. Starters and Overload Current Protection Devices (new).
5. Car Safety Device; maximum and minimum rated loads and rated speeds.
6. Governor (new)
7. Electric Door Operator; HP and RPM ratings, Voltage and Ampere rating of motor (new).
8. Hoistway Door Interlocks (new).
9. Car and Counterweight Buffers; maximum and minimum rated loads, maximum rated striking speed and stroke(existing to be re-used, or new).
10. Hoist and Compensation Ropes; ultimate breaking strength, allowable working load, and actual working load.
11. Cab Ventilation Unit; HP rating and CFM rating (new).

F. Complete construction drawings of elevator car enclosure, showing dimensioned details of construction, fastenings to platform, car lighting, ventilation, ceiling framing, top exits, and location of car equipment.



- G. Complete dimensioned detail of vibration isolating foundations for traction hoisting machines (existing to be re-used).
- H. Dimensioned drawings showing details of:
  - 1. All signal and operating fixtures (new).
  - 2. Car and counterweight roller guides (new).
  - 3. Hoistway door tracks, hangers, and sills (new).
  - 4. Door operator, infrared curtain units (new).
- I. Drawings showing details of controllers and supervisory panels.
- J. Furnish certificates as required under: Paragraph "QUALIFICATIONS".

#### **1.6 WIRING DIAGRAMS**

- A. Provide three complete sets of field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway, machine room and fixtures. Install one set coated with an approved plastic sealer and mounted in the elevator machine room as directed by the Resident Engineer.
- B. In the event field modifications are necessary during installation, diagrams shall be revised to include all corrections made prior to and during the final inspection. Corrected diagrams shall be delivered to the Resident Engineer within thirty (30) days of final acceptance.
- C. Provide the following information relating to the specific type of microprocessor controls installed:
  - 1. Owner's information manual, containing job specific data on major components, maintenance, and adjustment.
  - 2. System logic description.
  - 3. Complete wiring diagrams needed for field troubleshooting, adjustment, repair and replacement of components. Diagrams shall be base diagrams, containing all changes and additions made to the equipment during the design and construction period.
  - 4. Changes made during the warranty period shall be noted on the drawings in adequate time to have the finalized drawings reproduced for mounting in the machine room no later than six months prior to the expiration of the warranty period.

#### **1.7 ADDITIONAL EQUIPMENT**

- A. Additional equipment required to operate the specified equipment manufactured and supplied for this installation shall be furnished and installed by the Contractor. The cost of the equipment shall be included in the Base Bid.
- B. Equipment not required by specifications, which would improve the operation, may be installed in conjunction with the specified equipment by the Contractor at his option at no additional cost to the Government; provided prior approval is obtained from the Contracting Officer's Technical Representative.

#### **1.8 TOOL CABINET**

- A. Provide a metal parts/tool cabinet, having two shelves and hinged doors. Cabinet size shall be 1220 mm (48 in.) high, 762 mm (30 in.) wide, and 457 mm (18 in.) deep.

#### **1.9 PERFORMANCE STANDARDS**

- A. The elevators shall be capable of meeting the highest standards of the industry and specifically the following:
  - 1. Contract speed is high speed in either direction of travel with rated capacity load in the elevator. Speed variation under all load conditions, regardless of direction of travel, shall not vary more than five (5) percent.
  - 2. The controlled rate of change of acceleration and retardation of the car shall not exceed 0.1G per second, and the maximum acceleration and retardation shall not exceed 0.2G per second.
  - 3. Starting, stopping, and leveling shall be smooth and comfortable, without appreciable steps of acceleration and deceleration.
- B. The door operator shall open the car door and hoistway door simultaneously at 2.5-feet per second and close at 1-foot per second.
- C. Elevator control system shall be capable of starting the car without noticeable "roll-back" of hoisting machine sheave, regardless of load condition in car, location of car, or direction of travel.
- D. Floor level stopping accuracy shall be within 3 mm (1/8 in.) above or below the floor, regardless of load condition.

- E. Noise and Vibration Isolation: All elevator equipment (including their supports and fastenings to the building) shall be mechanically and electrically isolated from the building structure to minimize objectionable noise and vibration transmission to car, building structure, or adjacent occupied areas of building.
- F. Sound Isolation: Noise level relating to elevator equipment operation in machine room shall not exceed 80 dBA. All dBA readings shall be taken three (3) feet off the floor and three (3) feet from equipment.
- G. Airborne Noise: Measured noise level of elevator equipment during operation shall not exceed 50 dBA in elevator lobbies and 60 dBA inside car under any condition including door operation and car ventilation exhaust blower on its highest speed.

#### **1.10 WARRANTY**

- A. Submit all labor and materials furnished in connection with elevator system and installation to terms of "Warranty of Construction" articles of FAR clause 52.246-21. The one year Warranty shall commence after final inspection, completion of performance test, and upon full acceptance of the installation and shall concur with the guarantee period of service.
- B. During warranty period, if a device is not functioning properly or in accordance with specification requirements, or if in the opinion of the Contracting Officer's Technical Representative, excessive maintenance and attention must be employed to keep device operational, device shall be removed and a new device meeting all requirements shall be installed as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Where stainless steel is specified, it shall be corrosion-resisting steel complying with Federal Specification QQ-S-766, Class 302 or 304, Condition A with Number 4 finish on exposed surfaces. Stainless steel shall have the grain of belting in the direction of the longest dimension, and surfaces shall be smooth and without waves. During installation, all stainless steel surfaces shall be protected with suitable material.
- B. Where cold-rolled steel is specified, it shall be low-carbon steel rolled to stretcher leveled standard flatness, complying with ASTM A109.

### **2.2 MANUFACTURED PRODUCTS**

- A. Materials, devices, and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items. Items not meeting this requirement, but meeting technical specifications (which can be established through reliable test reports or physical examination of representative samples), will be considered.
- B. When two or more devices of the same class of materials or equipment are required, these units shall be the products of one manufacturer.
- C. Manufacturers of equipment assemblies which include components made by others shall assume complete responsibility for the final assembled unit.
  - 1. Individual components of assembled units shall be products of the same manufacturers.
  - 2. Parts which are alike shall be the product of a single manufacturer.
  - 3. Components shall be compatible with each other and with the total assembly for the intended service.
- D. Motor nameplates shall state manufacturer's name, rated horsepower, speed, volts, starting and full load amperes, and other characteristics required by NEMA Standards, and shall be securely attached to the item of equipment in a conspicuous location.

- E. The elevator equipment, including controllers, door operators, and supervisory system shall be the product of manufacturers of established reputation, provided such items are capably engineered and produced under coordinated specifications to ensure compatibility with the total operating system. Mixing of manufacturers related to a single system or group of components shall be identified in the submittals.
- F. Where key-operated switches are furnished in conjunction with any component of this elevator installation, furnish four (4) keys for each individual switch or lock. Provide different key tumblers for different switch and lock functions. Each and every key shall have a tag bearing a stamped or etched legend identifying its purpose. Barrel key switches are not acceptable, except where required by code.
- G. If the elevator equipment to be installed is not known to the Resident Engineer, the Contractor shall submit drawings in triplicate for approval to the Resident Engineer, Contracting Officer, and VA CFM Elevator Engineer showing all details and demonstrate that the equipment to be installed is in strict accordance with the specifications.

### **2.3 CAPACITY, SIZE, SPEED AND TRAVEL**

- A. Each and every elevator shall have the capacity to lift and lower the live load, including the weight of the car and cables, at the speed specified in the following schedule:

ELEVATOR SCHEDULE	
Elevator Number(s)	S-7 and S-8
Overall Platform Size	60 inches x 96 inches
Rated Load - kg (lb)	5,000 lbs./each
Contract Speed - m/s(fpm)	500 fpm
Total Travel - m/s(fpm)	150'-0"
Number of Stops	Twelve (12)
Number of Openings	48
Type of Roping	
Entrance Type and Size	SSCO, 48" x 84"

#### **2.4 POWER SUPPLY (EXISTING 480-3-60)**

- A. For power supply in each machine room, see Electrical drawings.
- B. It shall be the Electrical Contractor's responsibility to supply the labor and materials for the installation of the following:
  - 1. Feeders from the power source indicated on the drawings to each elevator controller.
  - 2. Shunt Trip Circuit Breaker for each controller shall be located inside machine room at the strike side of the machine room door and lockable in the "Off" position.
  - 3. Provide Surge Suppressors to protect the elevator equipment.
- C. Power for auxiliary operation of elevator as specified shall be available from auxiliary power generator, including wiring connection to the elevator control system.

#### **2.5 CONDUIT AND WIREWAY (EXISTING TO BE RE-USED)**

- A. Unless otherwise specified or approved, install electrical conductors (except traveling cable connections to the car) in rigid zinc-coated steel or aluminum conduit, electrical metallic tubing or metal wireways. **Rigid conduit smaller than 3/4 inch or electrical metallic tubing smaller than 1/2 inch electrical trade size shall not be used.** All raceways completely embedded in concrete slabs, walls, or floor fill shall be rigid steel conduit. Wireway (duct) shall be installed in the hoistway and to the controller and between similar apparatus in the elevator machine room. Fully protect self-supporting connections, where approved, from abrasion or other mechanical injury. Flexible metal conduit not less than 3/8 inch electrical trade size may be used, not exceeding 18 inches in length unsupported, for short connections between risers and limit switches, interlocks, and for other applications permitted by NEC.
- B. All conduits terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations shall have approved insulation bushings. Install a steel lock nut under the bushings if they are constructed completely of insulating materials. Protect the conductors at ends of conduits not terminating in steel cabinets or boxes by terminal fittings having an insulated opening for the conductors.

- C. Rigid conduit and EMT fittings using set screws or indentations as a means of attachment shall not be used. All fittings shall be steel or malleable iron.
- D. Connect motor or other items subject to movement, vibration or removal to the conduit or EMT systems with flexible, steel conduits.

## **2.6 CONDUCTORS (NEW)**

- A. Unless otherwise specified, conductors (excluding the traveling cables) shall be stranded or solid coated annealed copper in accordance with Federal Specification J-C-30B for Type RHW or THW. Where 16 and 18 AWG are permitted by NEC, single conductors or multiple conductor cables in accordance with Federal Specification J-C-580 for Type TF may be used, provided the insulation of single conductor cable and outer jacket of multiple conductor cable is both flame-retardant and moisture-resistant. Multiple conductor cable shall have color or number coding for each conductor. Conductors for control boards shall be in accordance with NEC. Joints or splices are not permitted in wiring except at outlets. Tap connectors may be used in wireways, provided they meet all UL requirements.
- B. Provide all conduit and wiring between machine room, hoistway and fixtures.
- C. All wiring must test free from short circuits or ground faults. Insulation resistance between individual external conductors and between conductors and ground shall be a minimum of one megohm.
- D. Where size of conductor is not given, voltage and amperes shall not exceed limits set by NEC.
- E. Provide equipment grounding. Ground the conduits, supports, controller enclosure, motor, platform and car frame, and all other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires shall be copper, green insulated and sized as required by NEC. Bond the grounding wires to all junction boxes, cabinets, and wire raceways.

F. Terminal connections for all conductors used for external wiring between various items of elevator equipment shall be solderless pressure wire connectors in accordance with Federal Specification W-S-610. The Elevator Contractor may, at his option, make these terminal connections on 10 gauge or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce-through serrated washers are not acceptable.

## **2.7 TRAVELING CABLES (NEW)**

A. All conductors to the car shall consist of flexible traveling cables conforming to the requirements of NEC. Traveling cables shall run from the junction box on the car directly to the controller. Junction boxes on the car shall be equipped with terminal blocks. Terminal blocks having pressure wire connectors of the clamp type that meet UL 486A requirements for stranded wire may be used in lieu of terminal eyelet connections. Terminal blocks shall have permanent indelible identifying numbers for each connection. Cables shall be securely anchored to avoid strain on individual terminal connections. Flame- and moisture-resistant outer covering must remain intact between junction boxes.  
**Abrupt bending, twisting and distortion of the cables shall not be permitted.**

B. Provide spare conductors equal to 10 percent of the total number of conductors furnished, but not less than 5 spare conductors in each traveling cable.

C. Provide shielded wires for the auto dial telephone system within the traveling cable. Add 5 pair shielded wires for card reader, 2 RG-6/U coaxial CCTV cables, and 2 pair 14 gauge wires for CCTV power as needed.

D. If traveling cables come into contact with the hoistway or elevator due to sway or change in position, provide shields or pads to the elevator and hoistway to prevent damage to the traveling cables.

E. Hardware cloth wide may be installed from the hoistway suspension point downward to the elevator pit, to prevent traveling cables from rubbing or chafing. Hardware cloth shall be securely fastened and tensioned to prevent buckling. Hardware cloth is not required when traveling cable is hung against a flat wall.



## **2.8 CONTROLLER AND SUPERVISORY PANEL (NEW)**

- A. UL/CSA Labeled Controller: Mount all assemblies, power supplies, chassis switches, and relays on a self-supporting steel frame. Completely enclose the equipment and provide a means to control the temperature. Solid state components shall be designed to operate between 32 to 104 degrees Fahrenheit, humidity non-condensing up to 85 percent.
- B. All controller switches and relays shall have contacts of design and material to ensure maximum conductivity, long life and reliable operation without overheating or excessive wear, and shall provide a wiping action to prevent sticking due to fusion. Switches carrying highly inductive currents shall be provided with arc shields or suppressors.
- C. Where time delay relays are used in the circuits, they shall be of acceptable design, adjustable, reliable, and consistent such as condenser timing or electronic timing circuits.
- D. Properly identify each device on all panels by name, letter, or standard symbol which shall be neatly stencil-painted or decaled in an indelible and legible manner. Identification markings shall be coordinated with identical markings used on wiring diagrams. The ampere rating shall be marked adjacent to all fuse holders. All spare conductors to controller and supervisory panel shall be neatly formed, laced, and identified.

## **2.9 MICROPROCESSOR CONTROL SYSTEM (NEW)**

- A. Provide a microprocessor-based system with absolute position/speed feedback encoded tape, to control the hoisting machine and signal functions in accordance with these specifications. Complete details of the components and printed circuit boards, together with a complete operational description, shall be submitted for approval.
  - 1. All controllers shall be non-proprietary.
  - 2. Proprietary tools shall not be necessary for adjusting, maintenance, repair, and testing of equipment.
  - 3. Controller manufacturer shall provide factory training, engineering and technical support, including all manuals and wiring diagrams to the VA Medical Center's designated Elevator Maintenance Service Provider.

4. Replacement parts shall be shipped overnight within 48 hours of an order being received.
- B. All controller assemblies shall provide smooth, step-less acceleration and deceleration of the elevator, automatically and irrespective of the load in the car. All control equipment shall be enclosed in metal cabinets with lockable, hinged door(s) and shall be provided with a means of ventilation. All non-conducting metal parts in the machine room shall be grounded in accordance with NEC. Cabinet shall be securely attached to the building structure.
- C. Circuit boards for the control of each and every elevator system; dispatching, signals, door operation and special operation shall be installed in a NEMA Type 1 General Purpose Enclosure. Circuit boards shall be moisture-resistant, non-corrosive, non-conductive, fabricated of non-combustible material and adequate thickness to support the components mounted thereon. Mounting racks shall be spaced to prevent accidental contact between individual circuit boards and modules.
- D. Modules shall be the type that plug into pre-wired mounting racks. Field-wiring or alteration shall not be necessary in order to replace defective modules.
- E. Each device, module and fuse (with voltage and ampere rating) shall be identified by name, letter or standard symbol in an approved indelible and legible manner on the device or panel. Coordinate identification markings with identical markings on wiring diagrams.
- F. The electrical connections between the printed circuit boards (modules) and the circuit connectors incorporated in the mounting racks shall be made through individual tabs, which shall be an integral part of each module. The tabs shall be nickel-gold plated or other approved metal of equal electrical characteristics. Modules shall be keyed or notched to prevent insertion of the modules in the inverted position.
- G. Light-emitting diodes (LED) shall be for visual monitoring of individual modules.
- H. Components shall have interlocking circuits to assure fail-safe operation, and to prevent elevator movement should a component malfunction.
- I. Method of wire-wrapping from point to point with connections on the mounting racks shall be submitted for approval.

- J. Field-wiring changes required during construction shall be made only to the mounting rack connection points and not to the individual module circuitry or components. If it is necessary to alter individual modules, they shall be returned to the factory where design changes shall be made and module design records changed so correct replacement units will be available.
- K. All logic symbols and circuitry designations shall be in accordance with ASME and NEC Standards.
- L. Solid-state components shall be designed to operate within a temperature range of 32 to 104 degrees Fahrenheit, humidity non-condensing up to 85 percent.
- M. Wiring connections for operating circuits and for external control circuits shall be brought to terminal blocks mounted in an accessible location within the controller cabinet. **Terminal blocks using pierce-through serrated washers shall not be used.**
- N. Elevator Monitoring System and Remote Control Interface:
  - 1. Provide additional hardware and software system to allow elevator monitoring and control from remote engineering station. Capabilities of this interface are to include the ability to:
    - a. Remotely monitor elevator status, faults, event buffers, alerts, configuration parameters and inputs, and the ability for trained professionals to remotely take control of elevator including:
      - 1) Ability to remotely re-set elevator faults and/or remotely reset power, to remotely return a shutdown elevator to service when possible;
      - 2) Ability to remotely control security functions and floor and elevator lockouts based on the VA's requirements;
      - 3) Ability to remotely remove the elevator from the group and test the elevator;
      - 4) Ability to enter hall and car calls remotely;
      - 5) Ability to remotely put the elevator on independent service for use by building personnel
    - b. Ability to interface to Remote Elevator Monitoring diagnostic equipment, to send elevator shutdown information to elevator contractor for fault analysis and dispatching by the remote engineers.

## **2.10 DC MOTOR CONTROL WITH REGENERATIVE DRIVE (NEW)**

### **A. Direct Current Motor Control:**

1. Elevator control shall be affected by means of a compact, solid-state motor control unit for each and every elevator with electrical characteristics to suit the power supply. The system shall consist of the necessary three phase, full-wave bridge rectifiers and be equipped with regenerative drive.
2. Solid-state motor control unit shall operate with high efficiency and low power consumption, have the capacity to handle peak currents typical of elevator service and contain a balanced, coordinated fault protection system which shall accomplish the following:
  - a. Protect the complete power circuit, and specifically the power semi-conductors, from failure under short circuit (bolted fault) conditions.
  - b. Protect against limited faults arising from partial grounds, partial shorts in the motor armature or in the power unit itself.
  - c. Protect the drive motor against sustained overloads. A solid-state overload circuit shall be used.
  - d. Protect motor and power unit against instantaneous peak overload.
  - e. Provide semi-conductor transient protection.
  - f. Provide phase sequence protection to ensure incoming line is phased properly.
  - g. Removable printed circuit boards shall be provided for the VVVF control. Design tabs so boards cannot be reversed.

## **2.11 AUXILIARY POWER OPERATION**

- A. The control system for Elevators S-7 and S-8 shall provide for the operation of at least one car per elevator bank on auxiliary power upon failure of the normal power supply.
- B. Auxiliary power supply, its starting means, transfer switch for transfer of elevator supply from normal to auxiliary power, two pair of conductors in a conduit from an auxiliary contact on the transfer switch (open or close contacts as required by Controller Manufacturer) to terminals in the group elevator controller and other related work shall be provided by the Electrical Contractor.

- C. Auxiliary equipment on elevator controllers, wiring between associated elevator controllers, and wiring between elevator controllers and remote selector panel as required to permit the elevators to operate as detailed, shall be provided by the Elevator Contractor.
- D. Upon loss of normal power supply, there shall be a delay before transferring to auxiliary power of 10 seconds minimum to 45 seconds maximum; this delay shall be accomplished through an adjustable timing device. Following this adjustable delay, the associated elevators shall function as follows:
1. Selector switch, Automatic position:
    - a. Not more than two elevators at a time in each group shall be automatically selected and returned to the main floor, at normal speed, cycle its car and hoistway doors and shut down, with "Door Open" button remaining operable.
    - b. As each elevator reaches the designated floor and shuts down, another elevator shall start and return to the designated floor.
    - c. Elevators that have been manually removed from automatic service and are on independent service, fire service or medical emergency shall receive an automatic return signal. Elevators on inspection service or out of service shall not receive a signal.
    - d. When an elevator is given a signal to return and it is unable to start its movement to the designated floor within 30 seconds it shall be by-passed. When an elevator is by-passed, another elevator shall start and return.
    - e. This process shall continue until all elevators have returned to the designated floor and shut down.
    - f. Any elevator or elevators by-passed on initial return signal shall be signaled again.
    - g. When all cars in group have returned to designated floor, two elevators in each group shall be designated for automatic operation. Individual cars in each group shall restart at 5 second intervals.

- h. If electric traction elevators S-7 and S-8 are keyed on to medical emergency service in the car prior to transfer to auxiliary power operation, medical emergency service shall be retained. A car call registered prior to transfer shall also be retained. This elevator shall be the first automatically selected elevator to operate on auxiliary power operation and complete its selected call demand. The elevator will return to the designated floor after the key switch is reset to normal position.
- 2. Selector switch, Manual operation:
  - a. Selector switch shall be mechanically and electrically interlocked to prevent the selection of more than two elevators from operating on auxiliary power.
  - b. The selector switch shall have positions marked with the number of each elevator controlled. It shall also have a position marked "Automatic". When the selector switch is set to the automatic position, the medical emergency service car shall operate on auxiliary power operation, or if none, the last car arriving at the designated floor shall operate on auxiliary power operation.
  - c. Change in selection of elevators shall be by means of the selection switch and shall occur only when the previous selected elevator is stopped at the designated floor.
  - d. The selector switch shall be locked out of operation when the system is in the normal mode of operation.
  - e. Locate the selector switch above the hall push button station at the designated level in a NEMA 1B flush type enclosure furnished with a brushed finish stainless steel hinged door and frame. The door shall contain a tumbler type lock furnished with four keys. The enclosure faceplate shall be identified "Auxiliary Power Control" with 13 mm (1/2 in.) engraved letters filled with black paint.

3. The inside of the selector panel shall be brushed finish stainless steel with each device identified with 3 mm (1/8 in.) engraving filled with black paint. The panel shall contain:
  - a. Selector switch for selecting the elevators shall be toggle or rotary type switch.
  - b. Pilot lights to indicate normal mode of operation, auxiliary power service available, and which elevator or elevators in each group is connected to auxiliary service.
  - c. A lamp test circuit consisting of a momentary contact push button to test all pilot lights in the circuit.
  - d. Provide a permanently mounted, easy to read, instruction plate which shall include operating instructions for auxiliary power service and instructions for lamp test circuits.
- E. Prior to the return of normal power an adjustable timed circuit shall be activated that will cause all cars to remain at a floor if already there or stop and remain at the next floor if in flight. Actual transfer of power from auxiliary power to normal building power shall take place after all cars are stopped at a floor with their doors open.
- F. Car lighting circuits shall be connected to the auxiliary power panel.

#### **2.12 EMERGENCY RESCUE OPERATION**

- A. Provide a power source to send the elevator to the nearest landing. After the elevator has leveled at the nearest landing, provide power to open the car and hoistway doors automatically. After a predetermined time, the doors shall close. Power shall stay applied to the door open button so the doors can be opened from the inside of the elevator. The elevator shall remain shut down at the landing until normal power is restored. Install a sign on the controller indicating that the power is applied to emergency rescue operator and door operator during loss of normal power.

#### **2.13 DUPLEX SELECTIVE COLLECTIVE AUTOMATIC OPERATION**

- A. Provide duplex selective collective automatic operation, for service elevators S-7 and S-8.
- B. Operate elevators from push buttons inside the cars and located at each and every floor between elevators. When cars are available, park one car at main floor (home car) and the other car at last call (free car). Respond to car calls and hall calls above main floor using the "free" car. Once a car has started, respond to registered calls in the

direction of travel and in the order the floors are reached. Do not reverse the car direction until all car calls have been answered, or until all hall calls ahead of the car and corresponding to the direction of car travel have been answered.

Slow and stop elevators automatically at floors corresponding to registered calls in the order in which they are approached in each direction of travel. As slowdown is initiated, automatically cancel the hall call and car call. Hold car at arrival floor an adjustable time interval to allow passenger transfer.

When the "free" car is clearing calls, the "home" car shall respond to the following:

1. Calls registered on "home" car push buttons.
  2. Up hall calls registered below "free" car.
  3. Up or down calls registered above "free" car while "free" car is traveling down.
  4. Hall calls when "free" car is delayed in its normal operation for a predetermined period.
- C. When both cars are clearing calls, stop only one car in response to any registered hall call. Return the first car to clear its calls to the main floor. Should last service required bring both cars to main floor, the first arriving car becomes the "free" car. Illuminate floor push button to indicate call registration. Extinguish light when call is answered.
- D. If a landing button is operated while the car and hoistway doors are closing at that floor, the call shall be registered for the next available elevator. Calls registered shall be canceled if closing doors are reopened by means of "DOOR OPEN" button or infrared curtain unit.
- E. When an elevator is delayed for a predetermined time interval or shuts down after it receives a start signal, the system shall automatically permit the remaining car in the group to respond to hall calls and to be dispatched in normal manner. When cause of delay is corrected, car shall automatically resume normal operation unless it has been manually removed from the system.



- F. Auxiliary Landing Call Operation: In the event of corridor call button circuit failure, elevators are to service each floor in both directions in a predetermined pattern without registration of a call within the elevators. Provide illuminated signal in each the controller to indicate that emergency dispatch operation is in effect. Restoration of the landing call button system shall cause normal operation to resume.
- G. Car lights and fan in the elevator shall not shut off when elevator is idle. Arrange circuits so that power to lights and outlets on top and bottom of car shall not be interrupted.
- H. Answer lower floor calls with the home car unless the free car is parked at the floor where the call occurs. If no car is parked at main level, answer calls below main floor using the first available car.

#### **2.14 GROUP SELECTIVE-COLLECTIVE AUTOMATIC OPERATION**

- A. Elevators S-7 and S-8 shall have group automatic operation, and shall be capable of balancing service and providing continuity of group operation with one or more cars removed from the system.
- B. Group supervisory computer control system shall govern the movement of the individual cars in the group in a fully zoned system to provide the maximum efficiency in serving the VA hospital traffic demands. The system shall electronically calculate and continuously evaluate the varying traffic demands and automatically change the method of dispatching, and send cars to various floors of the hospital as appropriate, to provide an effective response to the landing calls of prevalent traffic. The system shall function to accommodate the anticipated varying hospital traffic demand and be flexible so that it can be modified to accommodate changes in traffic patterns.
  - 1. Arrange the system to maintain movement of cars to satisfy all traffic demands which occur throughout the day. The system shall function on the basis of conditions as they exist at the present time and not on conditions as measured in a preceding time period.
  - 2. Any car, after satisfying all car calls and corridor calls in its direction of travel, shall become available for immediate dispatch to any floor where demand exists regardless of location or direction of travel.
  - 3. The system shall always dispatch an available car to the lower dispatching terminal when no other car is parked or approaching this floor.

4. Select cars for dispatch by a non-sequence selection system. The system shall select from available cars and assign cars for loading. Select cars in the order of arrival at the dispatching terminal.
- C. Two-way dispatching shall function during periods of appreciable traffic demand in both the up and down directions. Dispatch the cars up or down as appropriate to respond to the prevailing traffic demand. Each car shall answer unassigned landing calls ahead of it in its direction of travel until all calls not subject to load bypass have been answered. The method of dispatching shall include:
  1. Dispatching the cars from predetermined zones consisting of an approximate division of the floors served by the number of elevators in the group unless the anticipated traffic demands should dictate otherwise. A car, after responding to the last call in an unoccupied zone, shall become the available car for that zone. Other cars that become available shall be assigned to other zones. Available cars shall respond immediately to a demand in their respective zones, except an available car shall respond to a demand in an unoccupied zone, or if the demand in a zone exceeds an adjustable predetermined number, an additional available car shall be dispatched to that zone.
  2. Available cars at landings shall be assigned and dispatched to answer service demands in a manner which shall provide equitable service to all floors.
  3. An available car without a demand for service shall park with its doors closed.
  4. The dispatching method shall be flexible to provide efficient service for two-way traffic that becomes predominant in either the up or down direction.
- D. Off-hour dispatching shall function when the traffic demands subside to a degree of very light or inactive status. As the cars become inactive, they shall park with doors closed in assigned zones or seek an unoccupied zone. Station one car at the lobby floor with doors closed. When a demand for service occurs, the car or cars in the zone of demand shall be placed back in service automatically in order to satisfy the demand.

- E. Auxiliary Landing Call Operation: In the event of corridor call button circuit failure, elevators are to service each floor in both directions in a predetermined pattern without registration of a call within the elevators. Provide an illuminated signal in the group operation panel to indicate that emergency dispatch operation is in effect. Restoration of the landing call button system shall cause normal operation to resume.
- F. Car lights and fan in the elevator shall not shut off when elevator is idle. Arrange circuits so that power to lights and outlets on top and bottom of car shall not be interrupted.

**2.15 MACHINE ROOM MONITOR (CCTV): GROUP OPERATION**

- A. Install a monitor in the machine room located in the Group Dispatch Operation Cabinet. Provide separate cabinets for the passenger elevator group and for the service elevator group. Provide one keyboard for each terminal.
- B. The CCTV shall contain indicators to provide the following information:
1. The floor where each elevator is currently located.
  2. The direction that each elevator is currently traveling or is scheduled to travel.
  3. The location and direction of currently registered hall calls.
  4. Elevators that are currently out of service.
  5. Elevators that are currently bypassing hall calls.
  6. Elevators that are currently engaged in passenger transfers.
  7. Operations program under which entire group is currently operating.
  8. Zone divisions of the entire group.
  9. Door positions.
  10. Status indication for cars on independent service, car top inspection, stop switch activated, alarm activated, fire service, and earthquake protection activated, etc.
- C. The maintenance terminal shall be suitable for all troubleshooting procedures related to the specific type microprocessor installed on this project.

## **2.16 LOAD WEIGHING**

- A. Provide means for weighing car load for each and every elevator. When load in a car reaches an adjustable predetermined level of the rated capacity, that car shall bypass registered landing calls until the load in the car drops below the predetermined level. Calls bypassed in this manner shall remain registered for the next car. The initial adjustment of the load weighting bypass setting shall be 60 to 100 percent.

## **2.17 ANTI-NUISANCE FEATURE**

- A. If weight in the car is not commensurate with the number of registered car calls, cancel car calls. Systems that employ either load weighing or door protective device for activation of this feature are acceptable.

## **2.18 FIREFIGHTERS' SERVICE**

- A. Provide Firefighters' Service as per ASME A17.1 Section 2.27.
- B. Smoke Detectors:
  - 1. Smoke detection devices that are designated for actuation of Elevator Phase I "FIRE SERVICE" response in each elevator lobby, top of hoistway, and machine room shall be provided by others.
    - a. Elevator lobby smoke detectors shall activate only the elevators sharing the corresponding or common lobby.
    - b. Top of hoistway smoke detectors shall activate fire recall and the top of hoistway motorized vent.
    - c. Elevator or group of elevators serving separate isolated areas of the same floor shall have an independent smoke detection system.
    - d. Machine room smoke detectors shall activate fire recall for each and every elevator with equipment located in that machine room.
    - e. Hoistway ventilation, provided by others, located at the top of hoistway for elevators that penetrate more than three floors and meets the requirements of ASME A17.1 Section 2.1.4 and IBC Section 3004. The vent shall stay closed under power. When the top of hoistway smoke detector is activated, the power is removed from the vent and the vent shall open. When the smoke detector is reset, the vent shall close by power.

## **2.19 MEDICAL EMERGENCY SERVICE**

- A. Provisions shall be made for calling elevators S-7 and S-8 on "Medical Emergency" operating independently from the dispatch signals and landing call signals. Provide a two-position, key-operated, momentary contact, spring return switch at all floors.
- B. Install key switch in the floor landing push button fixture above the push buttons.
- C. Landing key switches shall be momentary pressure-spring return to "OFF" position. Provide a call registered light indicator adjacent to key switch. The landing key switch and the "Medical Emergency" key switch in the car shall not be operable by keys used for any other purpose in the hospital.
- D. When switch is activated at any floor, the call register light indicator shall illuminate at that floor only, and the elevator supervisory control system shall instantly select the nearest available elevator in service to respond to the medical emergency call. Immediately upon selection, all car calls within that car shall be cancelled. Transfer any landing calls which had previously been assigned that car to another car. If the selected car is traveling away from the medical emergency call, it shall slow down and stop at the nearest floor, maintain closed doors, reverse direction and proceed nonstop to the medical emergency call floor. If the selected car is traveling toward the medical emergency call floor, it shall proceed to that floor nonstop. If at the time of selection it is slowing down for a stop, the car shall stop, maintain doors closed, and start immediately toward the medical emergency floor.
- E. Arriving at the medical emergency floor, the car shall remain with doors open for 30 seconds. After this interval has expired and the car has not been placed on medical emergency operation from within the car, the car shall automatically return to normal service.
  - 1. Locate a "Medical Emergency" key switch in the upper section of each main car operating panel for selecting medical emergency service. Activation of the key switch will allow the car to accept a car call for any floor, close doors, and proceed nonstop to the floor desired. The return of the key switch to normal position will restore the car to normal service. The key shall be removable only in the off position.

- F. Any car in the group which is in group service may be selected. Additional medical emergency calls, as they are registered in the system, shall cause additional cars to respond as described below, always on the basis of one medical emergency call per car.
- G. Provide an LED illuminated indicator light next to the Medical Emergency key switch the same size as the Fire Service indicator. In the center of the rear cab panel provide a back lighted "MEDICAL EMERGENCY" LED illuminated display that shall flash on and off continuously when the car is assigned to this operation and until it is restored to normal service. "MEDICAL EMERGENCY" indicator shall be a photographic negative type 1830 mm (72 in.) to center above the floor, 152 mm (6 in.) wide X 76 mm (3 in.) high, with 12 mm (1/2 in.) high letters and legible only when illuminated.
- H. All of the key switches in the "Medical Emergency" system for each and every elevator shall operate from the same key. The medical emergency call service key shall not operate any other key switch in the elevator system, nor shall any other key required by the elevator system be able to operate the medical emergency call service switches.
- I. Should all the cars be operating on "Independent Service", the medical emergency service indicator lights in the car operating panel and rear wall shall be illuminated, buzzer shall sound, and the "Audio Voice" system shall direct the attendant to return the car to automatic operation.
- J. Should all the cars be out of service and unable to answer medical emergency calls, the call register light shall not illuminate.
- K. Each switch faceplate shall have legible indelible legends engraved or etched to indicate its identity and positions. All letters in faceplates shall be 6 mm (1/4 in.) high, filled with black paint.
- L. When Phase I fire recall is activated it shall over-ride elevators on medical emergency service and return them to the main or alternate fire service recall floor. When the fire emergency floor has been identified the attendants may complete their medical emergency run on Phase II firefighters' operation if life safety is not affected.
- M. Provide four (4) keys for each "Medical Emergency" key cylinder furnished.

## **2.20 ELEVATOR MACHINE BEAMS (EXISTING)**

A. Overhead beams shall meet the requirements of ASME A17.1 Section 2.9, to support machines and machinery in place to prevent any part from becoming loose or displaced under the conditions imposed in service.

Machine beams shall be designed as follows:

1. The load resting on the beams and supports shall include the complete weight of the machine, sheaves, controller, governor, and any other equipment, together with the portion of the machine room floor supported by the beams.
2. Two times the sum of the tensions in all wire ropes supported by the beams with rated load in the car.

## **2.21 GEARLESS TRACTION MACHINE (REFURBISH, RE-BUILD AND RE-USE EXISTING)**

A. Gearless Traction Hoist Machine:

1. Gearless traction machine with a DC motor, brake, drive sheave, and deflector sheave mounted in proper alignment on an isolated bedplate.
2. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.
3. Armature must be electrically balanced and together with motor coupling and brake, mechanically-balanced.
4. The structural design of the motor shall ensure perfect alignment of bearings. The rotating elements shall be dynamically balanced to minimize vibration.
5. Hoist machine shaft shall be supported by two bearings mounted on a bedplate or integral with machine frame. Shaft shall be of forged steel or close grain electric furnace cast steel.
6. Drive sheaves shall be free from cracks, sand holes, and other imperfections that would tend to injure the hoist ropes. Sheave shall be turned smooth and true with rope grooves of proper design to ensure maximum traction and maximum life of the hoist ropes. Traction sheave shall be mechanically coupled to the hoist motor shaft centered in a positive manner.

7. Hoisting machine brake shall be drum or disc type and shall have the capacity to hold the elevator with 125 percent of rated load.

Arrange brake circuits so that no current shall be applied to the brake coil prior to the establishment of the hoistway door interlock circuit, except during leveling, re-leveling, and hoistway access operation.

#### **2.22 SHEAVES (RE-USE EXISTING)**

- A. Provide deflector sheaves with a metal basket type guard mounted below the sheave, and a guard to prevent ropes from jumping out of grooves. Securely fasten guard to sheave beams.
- B. Two-to-one idler sheaves on car and counterweight, if used, shall be provided with metal guards that shall prevent foreign objects from falling between ropes and sheave grooves and accidental contact or injury to workers on top of the car. Fabricate sheave guards from not less than 10-gauge thick steel and install with minimum clearance between guard and cables to prevent ropes from jumping out of grooves.

#### **2.23 HOIST ROPES (NEW)**

- A. Provide elevator with the required number and size of ropes to ensure adequate traction for the range of loads, with a factor of safety not less than that required by ASME A17.1 Section 2.20. Hoisting ropes shall be pre-formed 8 x 19 or 8 x 25 traction steel, conforming to Federal Specification RR-W-410, with minimum nominal diameter of 0.50 inch. For machines located overhead, 6 x 19 preformed traction steel hoisting ropes may be used in lieu of 8 x 19 that meet the requirements of the sheave manufacturer, at the Elevator Contractor's option.
- B. Securely attach a corrosion-resistant metal data tag to one hoisting rope fastening on top of the elevator.
- C. Provide wedge type shackles.



## **2.24 HOIST ROPE COMPENSATION (NEW)**

A. Compensation shall consist of a necessary number and size of iron or steel wire ropes attached to the underside of car and counterweight frames, passing under a weighted idler sheave in pit. A metal tag giving the number, diameter, type, month and year installed, and the name of manufacturer of compensating ropes shall be securely attached to one of the compensating rope fastenings.

1. Provide means for equalizing tension in the compensating ropes.
2. Provide idler sheave with ball or roller bearings. Mount sheave on steel guide rails.
3. Provide a metal guard over compensating sheave.
4. Provide a sheave contact in accordance with ASME A17.1 Rule

2.26.2.3.

5. Provide take-up to compensate for future cable stretch.

## **2.25 GOVERNOR ROPE (NEW)**

- A. Governor Rope shall be 8 x 19 wire rope, preformed traction steel, uncoated, fiber core, conforming to Federal Specification RR-W-410 with minimum nominal diameter of 0.375 inch having a minimum safety factor of 5. Tiller rope construction is not acceptable.
- B. Under normal operation rope shall run free and clear of governor jaws, rope guards, and other stationary parts.
- C. Securely attach governor rope tag to governor rope releasing carrier. Data tag shall be corrosion-resisting metal and bear data as required by ASME A17.1 Section 2.18.

## **2.26 SPEED GOVERNOR (NEW)**

- A. Provide Centrifugal type car driven governor, in accordance with ASME A17.1 Section 2.18, to operate the car safety device and counterweight governor to operate the counterweight safety device. Governor shall be complete with weighted pit tension sheave, governor release carrier and mounting base with protected cable sleeves.
- B. Furnish overspeed switch and speed reducing switches when required.
- C. The governor rope clamping device shall be designed so that no appreciable damage to or deformation of the governor rope shall result from the stopping action of the device in operating the safety.

- D. Provide anti-friction metal bearings for the governor and pit tension sheaves. Bearing shall be either self-oiling or Zerk fitting type connections. Ball or roller bearings may be used in lieu of sleeve type.
- E. Provide metal guard over top of governor rope and sheaves.
- F. Governor, with the exception of finished surfaces, screw threads, etc., shall be factory-painted and shall operate freely. Field painting of governor parts shall be permitted in accordance with ASME A17.1 Rule 2.18.3.1.

**2.27 CAR AND COUNTERWEIGHT SAFETY DEVICE (RE-USE EXISTING)**

- A. Provide "Type B Safeties" on the elevator and counterweight that meet the requirements of ASME A17.1 Section 2.17.
- B. Field-testing of car safety and governor shall be as specified in Section 3.7 PRETEST and TEST of this specification.

**2.28 ASCENDING CAR OVERSPEED PROTECTION (ROPE GRIPPERS - NEW)**

- A. Provide a device to prevent ascending over speed and unintended motion away from the landing when the doors are not locked in accordance with ASME A17.1 Section 2.19.

**2.29 CAR AND COUNTERWEIGHT BUFFERS (RE-USE EXISTING)**

- A. Provide a minimum of two buffers for each car and one for each counterweight that meet the requirements of ASME A17.1 Section 2.22. Securely fasten buffers and supports to the pit channels and in the alignment with striker plates on car and counterweight. Each installed buffer shall have a permanently attached metal plate indicating its stroke and load rating. Buffer anchorage shall not puncture pit waterproofing.
- B. Design and install buffers to provide minimum car runby required by ASME A17.1 Rule 2.4.2.
- C. Furnish pipe stanchions and struts as required to properly support the buffer.

**2.30 COUNTERWEIGHTS (RE-USE EXISTING)**

- A. Elevator shall be counterweighted with the weight of the car plus 40-50 percent of the rated capacity load as required by the controller manufacturer.
- B. Furnish two (2) tie rods with cotter pins and double nuts at top and bottom. Install counterweight retainer plates or other approved means on tie rods to prevent counterweight sub-weights from jumping and/or rattling. Both ends of tie-rods shall be visible and accessible.
- C. Provide counterweight guards in the pit in accordance with ASME A17.1 Section 2.3.

**2.31 CAR AND COUNTERWEIGHT ROLLER/SLIDE GUIDES (NEW - SHOE ONLY)**

- A. Provide car and counterweight with adjustable roller guides.
- B. Each guide shall be of an approved type consisting of not less than three (3) wheels, each with a durable, resilient oil-resistant material tire rotating on ball bearings having sealed-in lubrication. Assemble rollers on a substantial metal base and mount to provide continuous spring pressure contact of all wheels with the corresponding rail surfaces under all conditions of loading and operation. Secure the roller guides at top and bottom on each side of car frame and counterweight frame. All mounting bolts shall be fitted with nuts, flat washers, split lock washers, and if required, beveled washers.
- C. Provide sheet metal guards to protect wheels on top of car and counterweight.
- D. Minimum diameter of car rollers shall be 150 mm (6 in.) unless the six wheel roller type is used. The entire elevator car shall be properly balanced to equalize pressure on all guide rollers. Cars shall be balanced in post-wise and front-to-back directions. Test for this balanced condition shall be witnessed at time of final inspection.
- E. Minimum diameter of counterweight rollers shall not be less than 100 mm (4 in.). Properly balance counterweight frame to equalize pressure on all guide rollers. The Contractor shall have the option of furnishing, for counterweight only, mechanically-adjusted roller guide in lieu of spring loaded roller guides as specified.

F. Equip all cars and counterweight with an auxiliary guiding device for each guide shoe, which shall prevent the car or counterweight from leaving the rails in the event that the normal guides are fractured. These auxiliary guides shall not, during normal operation, touch the guiding surfaces of the rails. Fabricate the auxiliary guides from hot-rolled steel plate, and mount between the normal guide shoes and the car and counterweight frames. The auxiliary guides may be an extension of the normal guide shoe mounting plate, if that plate is fabricated from hot rolled steel. The portion of the auxiliary guide which shall come in contact with the rail guiding surfaces, in the event of loss of the normal guides, shall be lined with an approved bearing material to minimize damage to the rail guiding surfaces.

## **2.32 GUIDE RAILS, SUPPORTS AND FASTENINGS (RE-USE EXISTING)**

- A. Guide rails shall conform to ASME A17.1 Section 2.23.
- B. Securely fasten guide rails to the brackets or other supports by heavy duty steel rail clips.
- C. Provide necessary car and counterweight rail brackets and counterweight spreader brackets of sufficient size and design to secure substantial rigidity to prevent spreading or distortion of rails under any condition.
  - 1. Slotted or oversized holes shall be fitted with flat washers and shall conform to ASME A17.1 Rule 2.23.10.3.
  - 2. Where fastenings are over 4.2 m (14 ft) apart, rails shall be reinforced with 228 mm (9 in.) channel or approved equal backing to secure the rigidity required.
- D. Rail joints and fishplates shall be in accordance with ASME A17.1 Rule 2.23.7. Rail joints shall not interfere with clamps and brackets. Design rail alignment shims to remain in place if fastenings become loose.
- E. Guide rails shall extend from channels on pit floor to within 76 mm (3 in.) of the underside of the concrete slab or grating at top of hoistway with a maximum deviation of 3.2 mm (1/8 in.) from plumb in all directions. Provide a minimum of 19 mm (3/4 in.) clearance between bottom of rails and top of pit channels.
- F. Guide rail anchorages in pit shall be made in a manner that will not reduce effectiveness of the pit waterproofing.

- G. In the event inserts or bond blocks are required for the attachment of guide rails, the Contractor shall furnish such inserts or bond blocks, and shall install them in the forms before the concrete is poured. Use inserts or bond blocks only in concrete or block work where steel framing is not available for support of guide rails. Expansion-type bolting for guide rail brackets will not be permitted.
- H. Guide rails shall be clean and free of any signs of rust, grease, or abrasion before final inspection. Paint the shank and base of the T-section with two field coats of manufacturer's standard enamel.
- I. After completion of car safety testing during final inspection, all marks left on rails by application of car safety shall be filed smooth.

#### **2.33 NORMAL AND FINAL TERMINAL STOPPING DEVICES (NEW)**

- A. Normal and final terminal stopping devices shall conform to ASME A17.1 Section 2.25.
- B. Mount terminal slowdown switches and direction limit switches on the elevator or in hoistway to reduce speed and bring car to an automatic stop at the terminal landings.
  - 1. Switches shall function with any load up to and including 125 percent of rated elevator capacity at any speed obtained in normal operation.
  - 2. Switches, when opened, shall permit operation of elevator in reverse direction of travel.
- C. Mount final terminal stopping switches in the hoistway.
  - 1. Switches shall be positively opened should the car travel beyond the terminal direction limit switches.
  - 2. Switches shall be independent of other stopping devices.
  - 3. Switches, when opened, shall remove power from hoist motor, apply hoist machine brake, and prevent operation of car in either direction.
- D. After final stopping switches have been adjusted, through bolt switches to guide rail.

#### **2.34 CROSSHEAD DATA PLATE AND CODE DATA PLATE (NEW)**

- A. Permanently attach a non-corrosive metal Data Plate to car crosshead. Data plate shall bear information required by ASME A17.1 Section 2.16.3 and 2.20.2.1.
- B. Permanently attach a Code Data Plate, in plain view, to the controller, ASME A17.1 Section 8.9.

### **2.35 WORKMAN'S LIGHTS AND OUTLETS (NEW)**

- A. Provide duplex GFCI-protected type receptacles and lamps with guards on top of each elevator car and beneath the platform. The receptacles shall be in accordance with Fed. Spec. W-C-596 for Type D7, 2-pole, 3-wire grounded type, rated for 15 amperes and 125 volts.

### **2.36 TOP-OF-THE CAR OPERATING DEVICE (NEW)**

- A. Provide a car-top operating device that meets the requirements of ASME A17.1 Section 2.26.
- B. The device shall be activated by a toggle switch mounted in the device. The switch shall be clearly marked "INSPECTION" and "NORMAL" on the faceplate, with 6 mm (1/4 in.) letters.
- C. Movement of the elevator shall be accomplished by the continuous pressure on a direction button and a safety button.
- D. Provide an emergency stop toggle type switch.
- E. Provide permanent identification for the operation of all components in the device.
- F. The device shall be permanently attached to the elevator crosshead on the side of the elevator nearest to the hoistway doors used for accessing the top of the car.

### **2.37 CAR LEVELING DEVICE (NEW)**

- A. Car shall be equipped with a two-way leveling device, to automatically bring the car to within 3 mm (1/8 in.) of exact level with the landing for which a stop is initiated regardless of load in car or direction.
- B. If the car stops short or travels beyond the floor, the leveling device within its zone shall automatically correct this condition, and maintain the car within 3 mm (1/8 in.) of level with the floor landing regardless of the load carried.
- C. Provide encoded steel tape, steel tape with magnets or steel vanes with magnetic switches. Submit design for approval.

### **2.38 EMERGENCY STOP SWITCHES (NEW)**

- A. Provide an emergency stop switch for each top-of-car device, pit, machine spaces, service panel and firefighters' control panel inside the elevator. Mount stop switches in the pit adjacent to pit access door, at top of the pit ladder 1220 mm (48 in.) above the bottom landing sill and 1220 mm (48 in.) above the pit floor adjacent to the pit ladder.

- B. Each stop switch shall be red in color and shall have "STOP" and "RUN" positions legibly and indelibly identified.

**2.39 MAIN CAR OPERATING PANEL (NEW - ONE ONLY)**

- A. Locate the main car operating panel in the car enclosure on the front return panel for passenger/service elevators. The top floor car call push button shall not be more than 1220 mm (48 in.) above the finished floor. Car call push buttons and indicator lights shall be round with a minimum diameter of 25 mm (1 in.), LED white light illuminated.
- B. One-piece front faceplate, with edges beveled 15 degrees, shall have the firefighters' service panel recessed into the upper section and the service operation panel recessed into the lower section, fitted with hinged doors. Doors shall have concealed hinges, be in the same front plane as the faceplate and fitted with cylinder type key-operated locks. Secure the faceplate with stainless steel tamperproof screws.
- C. All terminology on the main car operating panel shall be raised or engraved. Use 6 mm (1/4 in.) letters to identify all devices in upper section of the main car operating panel. The handicapped markings with contrasting background shall be recessed .030 inch in the faceplate, square or rectangular in shape, with the finished face of the 12 mm (1/2 in.) numerals and markings flush with the faceplates. Surface-mounted plates are not acceptable.
- D. The upper section shall contain the following items in order listed from top to bottom:
  - 1. Engrave elevator number, 25 mm (1 in.) high with black paint for contrast.
  - 2. Engrave capacity plate information with black paint for contrast with freight loading class and number of passengers allowed.
  - 3. Emergency car lighting system consisting of a rechargeable battery, charger, controls, and LED illuminated light fixture. The system shall automatically provide emergency light in the car upon failure or interruption of the normal car lighting service, and function irrespective of the position of the light control switch in the car. The system shall be capable of maintaining a minimum illumination of 1.0 foot-candle when measured 1220 mm (48 in.) above the car floor and approximately 305 mm (12 in.) in front of the car operating panel, for not less than four (4) hours.

4. LED illuminated digital car position indicator with direction arrows. Digital display floor numbers and direction arrows shall be a minimum of 50mm (2 in.) high.
5. Firefighters' Emergency Operation Panel shall conform to the requirements of ASME A17.1 Section 2.27. Firefighters' Panel shall be 1676 mm (66 in.) minimum to 1830 mm (72 in.) maximum to the top of the panel above finished floor.
6. Firefighters' Emergency Indicator Light shall be round with a minimum diameter of 25 mm (1 in.).
7. Medical Emergency switch marked "MEDICAL EMERGENCY" with two positions labeled "ON" and "OFF" and Medical Emergency Indicator Light located next to the key switch shall be round with a minimum diameter of 25 mm (1 in.). Instruction for Medical Emergency operation shall be engraved below the keyswitch and light.
8. Key-operated Independent Service; see Section 2.39 for detailed description.
9. Provide a Door Hold button on the faceplate next to the independent service key switch. It shall have "DOOR HOLD" indelibly marked on the button. Button shall light when activated. When activated, the door shall stay open for a maximum of one minute. To override door hold timer, push a car call button or door close button. Door Hold button is not ADA required and Braille is not needed.
10. Complete set of round car call push buttons, minimum diameter of 25 mm (1 in.), and LED white light illuminated, corresponding to the floors served. Car call buttons shall be legibly and indelibly identified by a floor number and/or letter not less than 12mm (1/2 in.) high in the face of the call button. Stack buttons in a single vertical column for low rise buildings up to six floors with front openings only.
11. Door Open and Door Close buttons shall be located below the car call buttons. They shall have "OPEN" and "CLOSE" legibly and indelibly identified by letters in the face of the respective button. The Door Open button shall be located closest to the door jamb as required by ADA.
  - a. Rear Door Open and Rear Door Close buttons shall be located below the Front Door Open and Front Door Close buttons. They shall



- have "REAR OPEN" and "REAR CLOSE" legibly and indelibly identified by letters in the face of the respective button.
12. Red Emergency Alarm button that shall be located below the car operating buttons. Mount the emergency alarm button not lower than 890 mm (35 in.) above the finished floor. It shall be connected to audible signaling devices as required by A17.1 Rule 2.27.1.2. Provide audible signaling devices including the necessary wiring.
  13. Emergency Help push button shall activate two-way communications by Auto Dial telephone system, as required by ASME A17.1 Rule 2.27.1.1.3. Help button shall be LED white light illuminated and flash when call is acknowledged. Legibly and indelibly label the button "HELP" in the face of the button with 12 mm (1/2 in.) high letters.
  14. Provide a corresponding Braille plate on the left side of each button. The handicapped markings with contrasting background shall be recessed .030 inch in the faceplate, square or rectangular in shape, with the finished face of the 12 mm (1/2 in.) numerals and markings flush with the faceplates. Surface-mounted plates are not acceptable.
- E. The service operation panel, in the lower section shall contain the following items:
1. Light switch labeled "LIGHTS" for controlling interior car lighting with its two positions marked "ON" and "OFF".
  2. Inspection switch that will disconnect normal operation and activate hoistway access switches at terminal landings. Switch shall be labeled "INSPECTION" with its two positions marked "ON" and "OFF".
  3. Three-position switch labeled "FAN" with its positions marked "HIGH", "LOW" and "OFF" for controlling car ventilating blower.
  4. Two-position, spring return, toggle switch or push button to test the emergency light and alarm device. It shall be labeled "TEST EMERGENCY LIGHT AND ALARM".
  5. Two position emergency stop switch, when operated, shall interrupt power supply and stop the elevator independently of regular operating devices. Emergency stop switch shall be marked "PULL TO STOP" and "PUSH TO RUN".

#### **2.40 INDEPENDENT SERVICE**

- A. Provide a legibly and indelibly labeled "INDEPENDENT SERVICE", two-position key operated switch on the face of the main car operating panel that shall have its positions marked "ON" and "OFF". When the switch is in the "ON" position, the car shall respond only to calls registered on its car dispatch buttons, and shall bypass all calls registered on landing push buttons. The car shall start when a car call is registered, car call button or door close button is pressed, car and hoistway doors are closed, and interlock circuits are made. When switch is returned to "OFF" position, normal service shall be resumed.

#### **2.41 CAR POSITION INDICATOR**

- A. Provide an alpha-numeric digital car position indicator in the main car operating panel, consisting of numerals and arrows not less than 50 mm (2 in.) high, to indicate position of car and direction of car travel. Locate position indicator at the top of the main car operating panel, illuminated by light emitting diodes.

#### **2.42 AUDIO VOICE SYSTEM**

- A. Provide digitized audio voice system activated by stopping at a floor. Audio voice shall announce floor designations, direction of travel, and special announcements. The voice announcement system shall be a natural-sounding human voice that receives messages, and shall comply with ADA requirements for audible car position indicators. The voice announcer shall have two separate volume controls; one for the floor designations and direction of travel, and another for special announcements. The voice announcer shall have a full range loud speaker, located on top of the cab. The audio voice unit shall contain the number of ports necessary to accommodate the number of floors, direction messages, and special announcements. Install voice announcer per manufacturer's recommendations and instructions. The voice system shall be the product of a manufacturer of established reputation. Provide manufacturer literature and list of voice messages.
1. Fire Service Message
  2. Medical Emergency Service Message
  3. "Please do not block doors"
  4. Provide special messages as directed by Resident Engineer.

#### **2.43 AUTO-DIAL TELEPHONE SYSTEM**

- A. Furnish and install a complete ADA-compliant intercommunication system.
- B. Provide a two-way communication device in the car with automatic dialing, tracking and recall features with shielded wiring to car controller in machine room. Provide dialer with automatic rollover capability with minimum two numbers.
- C. "HELP" button shall illuminate and flash when call is acknowledged. Button shall match floor push button design.
- D. Provide "HELP" button tactile symbol engraved signage and Braille adjacent to button mounted integral with car operating panels.
- E. The auto dial system shall be located in the auxiliary car operating panel. The speaker and unit shall be mounted on the backside of the perforated stainless steel plate cover.
- F. Each elevator shall have individual phone numbers.
- G. If the operator ends the call, the phone shall be able to redial immediately.

#### **2.44 CORRIDOR-OPERATING DEVICE FACEPLATES**

- A. Fabricate faceplates for elevator operating and signal devices from not less than 3 mm (1/8 in.) thick flat stainless steel with all edges beveled 15 degrees. Install all faceplates flush with surface on which they are mounted.
- B. Corridor push button faceplates shall be at least 127 mm (5 in.) wide by 305 mm (12 in.) high. The centerline of the landing push buttons shall be 1067 mm (42 in.) above the corridor floor.
- C. Elevator Corridor Call Station Pictograph shall be engraved in the faceplate.
- D. Fasten all car and corridor operating device and signal device faceplates with stainless steel tamperproof screws.
- E. Design corridor push button faceplates so that pressure on push buttons shall be independent of pressure on push button contacts.
- F. Engraved legends in faceplates shall have lettering 6 mm (1/4 in.) high filled with black paint.
- G. Provide a corresponding Braille plate on the left side of each button. The handicapped markings with contrasting background shall be recessed .030 inch in the faceplate, square or rectangular in shape, with the finished face of the 12 mm (1/2 in.) numerals and markings flush with the faceplates. Surface mounted plates are not acceptable.

#### **2.45 CORRIDOR-OPERATING DEVICES FOR SERVICE ELEVATORS**

- A. Provide one riser of landing call buttons located as shown on contract drawings.
- B. Fixtures for intermediate landings shall contain "UP" and "DOWN" buttons. Fixtures for terminal landings shall contain a single "UP" or "DOWN" button.
- C. Each button shall contain an integral registration LED white light which shall illuminate upon registration of a call and shall extinguish when that call is answered.
- D. The direction of each button shall be legibly and indelibly identified by arrows not less than 12 mm (1/2 in.) high in the face of each button.
- E. Two or more risers of landing call buttons, if specified, shall be cross-connected so that either "UP" or "DOWN" buttons at a floor shall be capable of registering a call to that floor for the entire elevator group. Registration of a landing call shall illuminate "UP" or "DOWN" buttons simultaneously, and upon satisfaction of that call, both buttons shall be extinguished simultaneously.
- F. Landing push buttons shall not re-open the doors while the car and hoistway doors are closing at that floor, the call shall be registered for the next available elevator. Calls registered shall be canceled if closing doors are re-opened by means of "DOOR OPEN" button or infrared curtain unit.

#### **2.46 DIGITAL CORRIDOR LANTERN/POSITION INDICATOR (MAIN FLOOR)**

- A. Provide each car with combination corridor lantern/position indicator digital display mounted over the hoistway entrances at each and every floor. Provide each terminal landing with "UP" or "DOWN", minimum 64 mm (2 1/2 in.) high digital arrow lanterns and each intermediate landing with "UP" and "DOWN" digital arrow lanterns. Each lens shall be LED illuminated of proper intensity, so shielded to illuminate individual lens only. The lenses in each lantern shall be illuminated green to indicate "UP" travel and red to indicate "DOWN" travel. Lanterns shall signal in advance of car arrival at the landing indicating the direction of travel whether or not corridor button has been operated at that floor. Hall calls shall receive immediate assignment to individual cars and hall lantern shall sound and illuminate. Corridor lanterns shall not be illuminated when a car passes a floor without stopping.

Each lantern shall be equipped with a clearly audible electronic chime which shall sound once for "UPWARD" bound car and twice for "DOWNWARD" bound car. Audible signal shall not sound when a car passes the floor without stopping. Provide adjustable sound level on audible signal. Car riding lanterns are not acceptable.

- B. Provide alpha-numeric digital position indicators directly over hoistway landing entranceways between the arrival lanterns at each and every floor. Indicator faceplate shall be stainless steel. Numerals shall be not less than 50 mm (2 in.) high with direction arrows. Cover plates shall be readily removable for re-lamping. The appropriate direction arrow shall be illuminated during entire travel of car in corresponding direction.
- C. Provide LED illumination in each compartment to indicate the position and direction the car is traveling by illuminating the proper alpha-numeric symbol. When the car is standing at a landing without direction established, arrows shall not be illuminated.

#### **2.47 HOISTWAY ACCESS SWITCHES (BOTTOM AND TOP FLOOR ONLY)**

- A. Provide hoistway access switches for elevator at top terminal landing to permit access to top of car, and at bottom terminal landing to permit access to pit. Elevators with center opening doors, mount the access key switch 1830 mm (6 ft) above the corridor floor next to the hoistway entrance jamb. Exposed portion of each access switch or its faceplate shall have legible, indelible legends to indicate "UP", "DOWN", and "OFF" positions. Submit design and location of access switches for approval. Each access switch shall be a constant pressure cylinder type lock having not less than five pins or five stainless steel disc combination with key removable only when switch is in the "OFF" position. Lock shall not be operable by any other key which will operate any other lock or device used for any other purpose at the VA Medical Center. Arrange the hoistway switch to initiate and maintain movement of the car. When the elevator is operated in the down direction from the top terminal landing, limit the zone of travel to a distance not greater than the top of the car crosshead level with the top floor.
- B. Provide emergency access for all hoistway entrances, keyways for passenger and service elevators, and locked door release system (key access) for freight elevators.

**2.48 HOISTWAY ENTRANCES: SERVICE ELEVATORS (RE-USE EXISTING)**

- A. Provide entrances of metal construction using cold-rolled steel. Door frames shall be constructed of stainless steel. Complete entrances with sills, hanger supports, hangers, tracks, angle struts, unit frames, door panels, fascia plates, toe guards, hardware, bumpers, sight guards and wall anchors.
- B. Provide one-piece extruded stainless steel sills with non-slip wearing surface, grooved for door guides and recessed for fascia plates. Sills shall have overall height of not less than 19 mm (3/4 in.), set true, straight, and level, with hoistway edges plumb over each other, and top surfaces flush with finished floor. Grout sills full length after installation.
- C. Construct hanger supports of not less than 4.5 mm (3/16 in.) thick steel plate, and bolted to strut angles.
- D. Structural steel angles 76 mm x 76 mm x 9 mm (3 in. x 3 in. x 3/8 in.) shall extend from top of sill to bottom of floor beam above, and shall be securely fastened at maximum 457 mm (18 in.) on center and at each end with two bolts.
- E. Provide jambs and head soffits, of not less than 14-gauge stainless steel, for entrances. Jambs and head soffits shall be bolted or welded construction, and provided with three anchors each side. Side jambs shall be curved type. Radius of curvature shall be 89 mm (3 1/2 in.). Head jamb shall be square type, and shall overhang corridor face of side jambs by 6 mm (1/4 in.). Rigidly fasten jambs and head soffits to building structure. Provide jambs with protective covering. After installation, protect jambs and head soffits with wood framing to prevent damage to finish during construction. Solidly grout jambs.
- F. Provide 14-gauge sheet steel fascia plates in hoistway to extend vertically from head of hanger support housing to sill above. Plates shall be the same width as the door opening of elevator and adequately reinforced to prevent waves and buckles. Below bottom terminal landing and over upper terminal landing provide shear guards beveled back to and fastened to the wall. Where rear openings are used, provide shear guards and fascia plates as required by ASME A17.1.

- G. Provide hoistway entrance with flush center opening hoistway doors for Elevators S-7 and S-8. Door panels shall be not less than 16-gauge stainless steel, flush type construction, and not less than 32 mm (1 1/4 in.) thick. Wrap stainless steel around the leading and trailing edges of the door panel. Top and bottom of door panels shall have continuous stiffener channels welded in place. Reinforcement of the door panels shall be approximately 1.0 mm (0.04 in.) in thickness and of the hat section type. At bottom of each and every panel, provide two removable laminated phenolic gibs or other approved material guides and a separate fire gib. Reinforce each door panel for hangers, interlock mechanism, drive assembly, and closer. One door panel for each entrance shall bear a BOCA label, Underwriters' label, or in lieu of this, labels from other accredited test laboratories may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to the COR. Fasten sight guard of 14-gauge stainless steel, extending full height of panel, to leading edge of each panel of center opening doors.
- H. Provide hangers for hoistway door panels and provide relating devices to transmit motion from one door panel to the other. Fasten the hangers to the door sections. Provide reinforcements at the point of attachment. The hanger shall have provisions for vertical and lateral adjustments. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with rubber or non-metallic sound-reducing tires mounted on a malleable iron or steel bracket. The hanger sheaves shall operate at a relatively low rotational speed, and shall roll on a high-carbon, cold-rolled or drawn steel track shaped to permit free movement of sheaves without regard to vertical adjustment of sheave, bracket or housing. Beneath the track and each hanger sheave, provide a hardened steel up-thrust roller capable of withstanding a vertical thrust equal to the carrying capacity of adjacent upper sheave. The up-thrust shall have fine vertical adjustments, and the face of the roller shaped so as to permit free movement of the hanger sheave. The up-thrust roller shall have ball or roller bearings. Provide the hanger sheaves with steel fire stops to prevent disengagement from tracks.
- I. Do not use hangers that are constructed integrally with the door panels.

- J. Provide raised numerals on cast, rear mounted plates for all openings. Numerals shall be a minimum of 50 mm (2 in.) high, located on each side of entrance frame, with centerline of 1524 mm (5 ft) above the landing sill. The number plates shall contain Braille.
- K. Provide unique car number on every elevator entrance at designated main fire service floor level, minimum 76 mm (3 in.) in height.

#### **2.49 ELECTRIC INTERLOCKS (NEW)**

- A. Equip each hoistway door with an interlock, functioning as hoistway unit system, to prevent operation of car until all hoistway doors are locked in closed position. Hoistway door interlocks shall not be accepted unless they meet the requirements of ASME A17.1 Section 2.12.
- B. Equip car doors with electric contact that prevents operation of car until doors are closed, unless car is operating in leveling zone or hoistway access switch is used. Locate door contact to prevent its being tampered with from inside of car. Car door contact shall not be accepted unless it meets the requirements of ASME A17.1 Section 2.12.
- C. Wiring installed from the hoistway riser to each door interlock shall be NEC type SF-2 or equivalent.
  - 1. Type SF-2 cable terminations in the interlock housing shall be sleeved with glass braid fillers or equivalent.
- D. Provide devices, either mechanical or electrical, that shall prevent operation of the elevator in event of damaged or defective door equipment that has permitted an independent car or hoistway door panel to remain in the "unclosed" and "unlocked" position.

#### **2.50 CAR FRAME: SERVICE ELEVATORS (RE-USE EXISTING)**

- A. Car frame shall conform to the requirements of ASME A17.1 Section 2.15, constructed of steel plates and structural shapes securely riveted, bolted, or welded together. **Iron casting shall not be permitted.** The entire assembly shall be rugged construction, and amply braced to withstand unequal loading of platform. Car frame members shall be constructed to relieve the car enclosure of all strains. Balance car front to back and side to side. Provide balancing weights and frames, properly located, to achieve the required true balance.



**2.51 CAR PLATFORM: SERVICE ELEVATORS (RE-USE EXISTING)**

- A. Construct the car platform to comply with all the requirements of ASME A17.1 Section 2.15.5. The platform shall be designed to withstand the forces developed under the loading conditions specified. Provide car entrances with extruded aluminum sill or better, with machined or extruded guide grooves. Cover underside and all exposed edges of wood filled platform with sheet metal of not less than 27-gauge, with all exposed joints and edges folded under. Fire-resistant paint is not acceptable. Platform shall have flexible composition flooring not less than 3 mm (1/8 in.) thick. For color, see Section 09 06 00, SCHEDULE FOR FINISHES. Adhesive material shall be type recommended by manufacturer of flooring. Lay flooring flush with threshold plate and base.
- B. Provide a platform guard (toe guard) that meets the requirements of ASME A17.1 Section 2.15.9, of not less than 12-gauge sheet-steel on the entrance side, extend 76 mm (3 in.) beyond each side of entrance jamb. Securely brace platform guard to car platform, and bevel bottom edge at a 60-75 degree angle from horizontal. Install platform in the hoistway, so that the clearance between front edge and landing threshold shall not exceed 32 mm (1 1/4 in.).
- C. Isolate the platform from the car frame by approved rubber pads or other equally effective means.
- D. Provide adjustable diagonal brace rods to hold platform firmly within car suspension frame.
- E. Provide a bonding wire between frame and platform.

**2.52 CAR ENCLOSURE: SERVICE ELEVATORS (NEW)**

- A. Car enclosure shall have a dome height inside the cab of 2440 mm (8 ft).
- B. Securely fasten car enclosure to platform by through bolts located at intervals of not more than 457 mm (18 in.) running through an angle at the base of panels to underside of platform. Provide 6 mm (1/4 in.) bolts with nuts and lock washers.
- C. Car enclosure base shall be of 14-gauge stainless steel, 152 mm (6 in.) high. Provide straight type base at front return sides. Vertical face of base at sides and rear shall be flush with or recessed behind the wainscot directly above the base. There shall be no exposed fastenings in base. Provide natural ventilation openings divided equally between

the bottom and top of the car enclosure that shall provide a minimum 3.5 percent of the inside car floor area.

- D. Construct canopy of not less than 12-gauge steel.
- E. Car top railings that meet the requirement of ASME A17.1 Rules 2.14.1.7 and 2.10.2.
- F. Front return wall panel, entrance columns, rear corner columns, entrance head-jamb and transom shall be 14-gauge stainless steel full height of car. Side and rear walls from top of base to top of panel shall be constructed of 14-gauge cold rolled steel. Side and rear walls up to 1220 mm (48 in.) above finished floor shall be covered with stainless steel. For Side and rear walls, see Section 09 60 00, SCHEDULE FOR FINISHES. Color is specified in Section 09 06 00, SCHEDULE FOR FINISHES, Interior shall be flush panel construction with angles welded on exterior to ensure adequate rigidity. Coat exterior of panels with mastic sound insulation material approximately 2.5 mm (3/32 in.) thick followed by a prime coat of paint. Mastic material shall conform to ASTM E1042.
  - 1. Smooth and flush all joints with no ragged or broken edges.
- G. Provide a hinged top emergency exit cover. Exit shall be unobstructed when open and shall have mechanical stops on the cover. Provide a code-approved exit switch to prevent operation of the elevator when the emergency exit is open.
- H. Provide duplex, GFCI protected type receptacle in car. Locate flush-mounted receptacle on the centerline of the main car operating panel, 150 mm (6 in.) above the car floor.
- J. Lighting for service elevators:
  - 1. Provide car lighting with indirect fluorescent or LED lamps mounted in lighting coves along each side of the cab ceiling, front to back.
  - 2. Equip the lighting cove with asymmetrical polished aluminum reflectors having a specular anodized finish. Maintain a minimum light level of 50-foot candles 914 mm (36 in.) above finished floor at the car operating panels.
  - 3. Enclose the entire vertical space between the light trough outer edge and the cab canopy with approved opaque white or clear lumicite sheeting. Install the lumicite sheeting so that it is removable for cleaning and re-lamping.

- K. Provide a blower unit arranged to exhaust through an opening in the canopy. Provide a stainless or chrome plated fan grill around the opening. Provide 2-speed fan, capable of rated free delivery air displacement of approximately 380 and 700 cfm at respective speeds. Mount fan on top of car with rubber isolation to prevent transmission of vibration to car structure. Provide screening over intake and exhaust end of blower. Provide a 3-position switch to control the unit in the service panel.
- L. Provide car enclosure with two sets of stainless steel handrails.
1. 100 mm (4 in.) wide x 9 mm (3/8 in.) thick flatstock located with centerlines 750 mm and 1050 mm (30 in. and 42 in.) above the car floor.
  2. Locate handrails 38 mm (1 1/2 in.) from cab wall. Install handrails on two sides. Curve ends of handrails to walls. Conceal all handrail fastenings. Handrails shall be removable from inside the car enclosure.
- M. Provide car entrance with single speed center opening horizontal sliding car doors, of same type as hoistway doors for Elevators S-7 and S-8. Construct door panels to be flush hollow metal construction, not less than 32 mm (1 1/4 in.) thick, consisting of one continuous piece 16-gauge No. 4 stainless steel on car side face wrapped around the leading and trailing edges. Separate two plates by a sound-deadening material, and reinforce by steel shapes welded to the plates at frequent intervals. Reinforce panels as required for installation of hangers, power-operating and door-opening devices. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with rubber or non-metallic sound-reducing tires. Equip hangers with adjustable ball-bearing rollers to take upward thrust of panels. Upthrust rollers shall be capable of being locked in position after adjustment to a maximum of .38 mm (1/64 in.) clearance. Provide two laminated phenolic gibs on each door panel. Gibs shall be replaceable without removal of door panel. Provide door drive assembly, restrictor, gate switch, header, track, arms, and all related door hardware.

- N. Provide each service elevator one set of protection pads of sufficient length to completely cover two sides, rear walls and front return of cab interior. Pads shall consist of a minimum of 6 mm (1/4 in.) thick glass fiber insulation securely sewn between flame resistant vinyl coated coverings. Insulation shall conform to ASTM E84, UL 723, NFPA 252, CAN/ULC S102.2, or ASTM C612. Color of the covering shall be approved by the Resident Engineer. Provide stainless steel pad buttons or hooks, spaced at intervals of not more than 150 mm (18 in.) to adequately support pads.

**2.53 POWER DOOR OPERATORS: SERVICE ELEVATORS**

- A. Provide a high-speed heavy duty door operator to automatically open the car and hoistway doors simultaneously when the car is level with the floor, and automatically close the doors simultaneously at the expiration of the door-open time. Provide solid-state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position, and motor current. Motor shall be of the high-internal resistance type, capable of withstanding high currents resulting from stall without damage to the motor. The door operator shall be capable of opening a car door and hoistway door simultaneously, at a speed of .762 m (2.5 ft) per second. The closing speed of the doors shall be .3 m (1 ft) per second. A reversal of direction of the doors from the closing to opening operation (whether initiated by obstruction of the infrared curtain or the door "OPEN" button) shall be accomplished within 38 mm (1.5 in.) maximum of door movement. Emphasis is placed on obtaining quiet interlock and door operation; smooth, fast, dynamic braking for door reversals, stopping of the door reversal, and stopping of the doors at extremes of travel. Construct all levers and drive arms operating the doors, of heavy steel members, and all pivot points shall have ball or roller bearings. Auxiliary automatic door closers required under ASME A17.1 Section 2.11.3 shall be spring-loaded, sill-mounted type.

- B. Hoistway doors and car gates shall be manually operable in an emergency without disconnecting the power door operating equipment, unless the car is outside the unlocking zone.
1. It shall not be possible for the doors to open by power unless the elevator is within the leveling zone.
  2. Provide infrared curtain unit. The device shall cause the car and hoistway doors to reverse automatically to the fully-open position should the unit be actuated while the doors are closing. Unit shall function at all times when the doors are not closed, irrespective of all other operating features. The leading edge of the unit shall have an approved black finish.
- C. Should the doors be prevented from closing for more than a predetermined adjustable interval of 20 to 60 seconds by operation of the curtain unit, the doors shall stay open, the audio voice message and a buzzer located on the car shall sound only on automatic operation. **Do not provide door nudging.**
1. If an obstruction of the doors should not activate the photo-electric door control device and prevent the doors from closing for more than a predetermined adjustable interval of 15 to 30 seconds, the doors shall reverse to the fully open position and remain open until the "Door Close" button re-establishes the closing cycle.
- D. Provide door "OPEN" and "CLOSE" buttons. When the door "OPEN" button is pressed and held, the doors (if in the open position) shall remain open and if the doors are closing, they shall stop, reverse and re-open. Momentary pressure of the door "CLOSE" button shall initiate the closing of the doors prior to the expiration of the normal door open time.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Examine work of other trades on which the work of this Section depends. Report defects to the Resident Engineer in writing that may affect the work of this trade or equipment operation dimensions from site for preparation of shop drawings.
- B. Ensure that shafts and openings for moving equipment are plumb, level and in line, and that pit is to proper depth, waterproofed and drained with necessary access doors, ladder and guard.
- C. Ensure that machine room is properly illuminated, heated and ventilated, and equipment, foundations, beams correctly located complete with floor and access stairs and door.
- D. Before fabrication, take necessary job site measurements, and verify where work is governed by other trades. Check measurement of space for equipment, and means of access for installation and operation. Obtain dimensions from site for preparation of shop drawings.
- E. Ensure the following preparatory work, provided under other sections of the specification has been provided. If the Elevator Contractor requires changes in size or location of trolley beams or their supports and trap doors, etc., to accomplish their work, he must make arrangements, subject to approval of the Contracting Officer, and include additional cost in their bid. Where applicable, locate controller near and visible to its respective hoisting machinery. Work required prior to the completion of the elevator installation:
  - 1. Supply of electric feeder wires to the terminals of the elevator control panel, including circuit breaker.
  - 2. Provide light and GFCI outlets in the elevator pit and machine room.
  - 3. Furnish electric power for testing and adjusting elevator equipment.
  - 4. Furnish circuit breaker panel in machine room for car and hoistway lights and receptacles.
  - 5. Supply power for cab lighting and ventilation from an emergency power panel specified in Division 26, ELECTRICAL.
  - 6. Machine room enclosed and protected from moisture, with self-closing, self-locking door and access stairs.
  - 7. Provide fire extinguisher in machine room.

- F. Supply for installation, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

### **3.2 SPACE CONDITIONS**

- A. Attention is called to overhead clearance, pit clearances, overall space in machine room, and construction conditions at building site in connection with the elevator work. Addition or revision of space requirements, or construction changes that may be required for the complete installation of the elevators must be arranged for and obtained by the Contractor, subject to approval by the Resident Engineer. Include cost of changes in bid that become a part of the contract. Provide proper, code legal installation of equipment, including all construction, accessories and devices in connecting with elevator, mechanical and electrical work specified.
- B. Where concrete beams, floor slabs, or other building construction protrude more than 50 mm (2 in.) into hoistway, bevel all top surfaces of projections to an angle of at 75 degrees with the horizontal.

### **3.3 INSTALLATION**

- A. Perform work with competent Certified Elevator Mechanics and Apprentices skilled in this work and under the direct supervision of the Elevator Contractor's experienced foreman.
- B. Set hoistway entrances in alignment with car openings, and true with plumb sill lines.
- C. Erect hoistway sills, headers and frames prior to erection of rough walls and doors. Erect fascias and toe guards after rough walls are finished.
- D. Install machinery, guides, controls, car and all equipment and accessories in accordance with manufacturer's instructions, applicable codes and standards.
- E. Isolate and dampen machine vibration with properly sized sound-reducing anti-vibration pads.
- F. Grout sills and hoistway entrance frames.

### **3.4 ARRANGEMENT OF EQUIPMENT**

- A. Clearance around elevator, mechanical and electrical equipment shall comply with applicable provisions of NEC. Arrange equipment in machine room so that major equipment components can be removed for repair or replacement without dismantling or removing other equipment in the same machine room. Locate controller near and visible to its respective hoisting machine.

### **3.5 WORKMANSHIP AND PROTECTION**

- A. Installations shall be performed by Certified Elevator Mechanics and Apprentices to best possible industry standards. Details of the installation shall be mechanically and electrically correct. Materials and equipment shall be new and without imperfections.
- B. Recesses, cutouts, slots, holes, patching, grouting, refinishing to accommodate installation of equipment shall be included in the Contractor's work. All new holes in concrete shall be core-drilled.
- C. Structural members shall not be cut or altered. Work in place that is damaged or defaced shall be restored equal to original new condition.
- D. Finished work shall be straight, plumb, level, and square with smooth surfaces and lines. All machinery and equipment shall be protected against dirt, water, or mechanical injury. At final completion, all work shall be thoroughly cleaned and delivered in perfect unblemished condition.
- E. Beams, slabs, or other building construction protruding more than four inches into the hoistway, all top surfaces shall be beveled at an angle of at least 75 degrees to the horizontal.
- F. Sleeves for conduit and other small holes shall project 50 mm (2 in.) above concrete slabs.
- G. Hoist cables that are exposed to accidental contact in the machine room and pit shall be completely enclosed with 16-gauge sheet metal or expanded metal or guards.
- H. Exposed gears, sprockets, and sheaves shall be guarded from accidental contact in accordance with ASME A17.1 Section 2.10.



### **3.6 CLEANING**

- A. Clean machine room and equipment.
- B. Perform hoistway clean down.
- C. Prior to final acceptance; remove protective coverings from finished or ornamental surfaces. Clean and polish surfaces with regard to type of material.

### **3.7 PAINTING AND FINISHING**

- A. Hoist machine, motor, shall be factory-painted with manufacturer's standard finish and color.
- B. Controller, sheave, car frame and platform, counterweight, beams, rails and buffers, except their machined surfaces, cams, brackets and all other uncoated ferrous metal items shall be painted one factory-priming coat or approved equal.
- C. Upon completion of installation and prior to final inspection, all equipment shall be thoroughly cleaned of grease, oil, cement, plaster and other debris. All equipment, except that otherwise specified as to architectural finish, shall then be given two coats of paint of approved color, conforming to manufacturer's standard.
- D. Field painting of governors shall be in accordance with ASME A17.1 Rule 2.18.3.1.
- E. Stencil or apply decal floor designations not less than 100 mm (4 in.) high on hoistway doors, fascias or walls within door restrictor areas as required by ASME A17.1 Rule 2.29.2. The color of paint used shall contrast with the color of the surfaces to which it is applied.
- F. Elevator hoisting machine, controller, governor, main line shunt trip circuit breaker, safety plank, and cross head of car shall be identified by 100 mm (4 in.) high numerals and letters located as directed. Numerals shall contrast with surrounding color and shall be stenciled or decaled.
- G. Hoistway Entrances of Service Elevators:
  - 1. Door panels shall be parkerized or given equivalent rust-resistant treatment and a factory finish of one coat of baked-on primer and one factory finish coat of baked-on enamel.
  - 2. Fascia plates, top and bottom shear guards, dust covers, hanger covers, and other metalwork, including built-in or hidden work and structural metal, (except stainless steel entrance frames and surfaces to receive baked enamel finish) shall be given one approved

prime coat in the shop, and one field coat of paint of approved color.

H. Elevator Cabs for Service Elevators:

1. Interior and exterior steel surfaces shall be parkerized or given equivalent rust-resistant treatment before finish is applied.
2. Interior steel surfaces shall be factory finished with one coat of baked on enamel or proxylin lacquer. For color, see Section 09 06 00, SCHEDULE FOR FINISHES.
3. Give exterior faces of car doors one finish coat of paint of medium gray color.

**3.8 PRE-TESTS AND TESTS**

- A. Pre-test the elevators and related equipment in the presence of the Resident Engineer or his authorized representative for proper operation before requesting final inspection. Conduct final inspection at other than normal working hours, if required by Resident Engineer.
1. Procedure outlined in the Inspectors Manual for Electric Elevators, ASME A17.2 shall apply.
    - a. Final test shall be conducted in the presence of and witnessed by an ASME QEI-1 Certified Elevator Inspector.
    - b. Government shall furnish electric power including necessary current for starting, testing, and operating machinery of each elevator.
  2. Contractor shall furnish the following test instruments and materials on-site and at the designated time of inspection: properly marked test weights, voltmeter, amp probe, thermometers, direct reading tachometer, megohm meter, vibration meter, sound meter, light meter, stop watch, and a means of two-way communication.
- B. Inspect workmanship, equipment furnished, and installation for compliance with specification.
- C. Balance Tests: The percent of counterbalance shall be checked by placing test weights in car until the car and counterweight are equal in weight when located at the mid-point of travel. If the actual percent of counter balance does not conform to the specification, the amount of counterweight shall be adjusted until conformance is reached.

- D. Full-Load Run Test: Elevators shall be tested for a period of one hour continuous run with full contract load in the car. The test run shall consist of the elevator stopping at all floors, in either direction of travel, for not less than five or more than ten seconds per floor.
- E. Speed Test: The actual speed of the elevator shall be determined in both directions of travel with full contract load, balanced load and no load in the elevator. Speed shall be determined by applying a certified tachometer to the car hoisting ropes or governor rope. The actual measured speed of the elevator with all loads in either direction shall be within three (3) percent of specified rated speed. Full speed runs shall be quiet and free from vibration and sway.
- F. Temperature Rise Test: The temperature rise of the hoisting motor shall be determined during the full load test run. Temperatures shall be measured by the use of thermometers. Under these conditions, the temperature rise of the equipment shall not exceed 50 degrees Centigrade above ambient temperature. Test shall start when all machine room equipment is within five (5) degrees Centigrade of the ambient temperature. Other tests for heat runs on motors shall be performed as prescribed by the Institute of Electrical and Electronic Engineers.
- G. Car Leveling Test: Elevator car leveling devices shall be tested for accuracy of leveling at all floors with no load in car, balanced load in car, and with contract load in car, in both directions of travel. Accuracy of floor level shall be within plus or minus 3 mm (1/8 in.) of level with any landing floor for which the stop has been initiated regardless of load in car or direction of travel. The car leveling device shall automatically correct over travel as well as under travel and shall maintain the car floor within plus or minus 3 mm (1/8 in.) of level with the landing floor regardless of change in load.
- H. Brake Test: The action of the brake shall be prompt and a smooth stop shall result in the up and down directions of travel with no load and rated load in the elevator. Down stopping shall be tested with 125 percent of rated load in the elevator.
- I. Insulation Resistance Test: The elevator's complete wiring system shall be free from short circuits and ground faults and the insulation resistance of the system shall be determined by use of megohm meter, at the discretion of the Elevator Inspector conducting the test.

- J. Safety Devices and Governor Tests: The safety devices and governor shall be tested as required by ASME A17.1 Section 8.10.
- K. Overload Devices: Test all overload current protection devices in the system at final inspection.
- L. Limit Stops:
1. The position of the car when stopped by each of the normal limit stops with no load and with contract load in the car shall be accurately measured.
  2. Final position of the elevator relative to the terminal landings shall be determined when the elevator has been stopped by the final limits. The lower limit stop shall be made with contract load in the elevator. Elevator shall be operated at inspection speed for both tests. Normal limit stopping devices shall be inoperative for the tests.
- M. Oil Buffer Tests: These tests shall be conducted with operating device and limit stops inoperative and with contract load in the elevator for the car buffer and with no load in the elevator for the counterweight buffer. Preliminary test shall be made at the lowest (leveling) speed. Final tests shall be conducted at contract speed. Buffers shall compress and return to the fully extended position without oil leakage.
- N. Setting of Car Door Contacts: The position of the car door at which the elevator may be started shall be measured. The distance from full closure shall not exceed that required by ASME A17.1. The test shall be made with the hoistway doors closed or the hoistway door contact inoperative.
- O. Setting of Interlocks: The position of the hoistway door at which the elevator may be started shall be measured and shall not exceed ASME A17.1 requirements.
- P. Operating and Signal System: The elevator shall be operated by the operating devices provided and the operation signals and automatic floor leveling shall function in accordance with requirements specified. Starting, stopping and leveling shall be smooth and comfortable without appreciable steps of acceleration or deceleration.
- Q. Performance of the Elevator supervisory system shall be witnessed and approved by the representative of the Resident Engineer.

- R. Evidence of malfunction in any tested system or parts of equipment that occurs during the testing shall be corrected, repaired, or replaced at no additional cost to the Government, and the test repeated.
- S. If equipment fails test requirements and a re-inspection is required, the Contractor shall be responsible for the cost of re-inspection; salaries, transportation expenses, and per-diem expenses incurred by the representative of the Resident Engineer.

### **3.9 INSTRUCTION OF VA PERSONNEL / TRAINING**

- A. Provide competent instruction to VA personnel regarding the operation of equipment and accessories installed under this contract, for a period equal to one eight hour day. Instruction shall commence after completion of all work and at the time and place directed by the Resident Engineer.
- B. Written instructions in triplicate relative to care, adjustments and operation of all equipment and accessories shall be furnished and delivered to the Resident Engineer in independently bound folders. DVD recordings will also be acceptable. Written instructions shall include correct and legible wiring diagrams, nomenclature sheet of all electrical apparatus including location of each device, complete and comprehensive sequence of operation, complete replacement parts list with descriptive literature, and identification and diagrammatic cuts of equipment and parts. Information shall also include electrical operation characteristics of all circuits, relays, timers, and electronic devices, as well as R.P.M. values and related characteristics for all rotating equipment.
- C. Provide supplementary instruction for any new equipment that may become necessary because of changes, modifications or replacement of equipment or operation under requirements of paragraph entitled "Warranty of Construction".

### **3.10 INSPECTIONS AND SERVICE: GUARANTEE PERIOD OF SERVICE**

- A. Furnish complete inspection and maintenance service on entire elevator installation for a period of one (1) year after completion and acceptance of all the elevators in this specification by the Resident Engineer. This maintenance service shall run concurrently with the warranty. Maintenance work shall be performed by Certified Elevator Mechanics and Apprentices employed and supervised by the company that is providing guaranteed period of service on the elevator equipment specified herein.
- B. This contract will cover full maintenance including emergency call back service, inspections, and servicing the elevators listed in the schedule of elevators. The Elevator Contractor shall perform the following:
  - 1. Bi-weekly systematic examination of equipment.
  - 2. During each maintenance visit the Elevator Contractor shall clean, lubricate, adjust, repair and replace all parts as necessary to keep the equipment in first class condition and proper working order.
  - 3. Furnishing all lubricant, cleaning materials, parts and tools necessary to perform the work required. Lubricants shall be only those products recommended by the manufacturer of the equipment.
  - 4. Equalizing tension, shorten or renew hoisting ropes where necessary to maintain the safety factor.
  - 5. As required, motors, controllers, selectors, leveling devices, operating devices, switches on cars and in hoistways, hoistway doors and car doors or gate operating device, interlock contacts, guide shoes, guide rails, car door sills, hangers for doors, car doors or gates, signal system, car safety device, governors, tension and sheaves in pit shall be cleaned, lubricated and adjusted.
  - 6. Guide rails, overhead sheaves and beams, counterweight frames, and bottom of platforms shall be cleaned every three months. Car tops and machine room floors shall be cleaned monthly. Accumulated rubbish shall be removed from the pits monthly. A general cleaning of the entire installation including all machine room equipment and hoistway equipment shall be accomplished quarterly. Cleaning supplies and vacuum cleaner shall be furnished by the Contractor.
  - 7. Maintain the performance standards set forth in this specification.

8. The operational system shall be maintained to the standards specified hereinafter including any changes or adjustments required to meet varying conditions of hospital occupancy.
9. Maintain smooth starting and stopping and accurate leveling at all times.
- C. Maintenance service shall not include the performance of work required as a result of improper use, accidents, and negligence for which the Elevator Contractor is not directly responsible.
- D. Provide 24-hour emergency call-back service that shall consist of promptly responding to calls within two hours for emergency service should a shutdown or emergency develop between regular examinations. Overtime emergency call-back service shall be limited to minor adjustments and repairs required to protect the immediate safety of the equipment and persons in and about the elevator.
- E. Service and emergency personnel shall report to the Resident Engineer or his authorized representative upon arrival at the hospital and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed shall be given to the Resident Engineer or his authorized representative.
- F. The Elevator Contractor shall maintain a log book in the machine room. The log shall list the date and time of all weekly examinations and all trouble calls. Each trouble call shall be fully described including the nature of the call, necessary correction performed or parts replaced.
- G. Written "Maintenance Control Program" shall be in place to maintain the equipment in compliance with ASME A17.1 Section 8.6.

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**SECTION 21 05 11**  
**COMMON WORK RESULTS FOR FIRE SUPPRESSION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. The requirements of this Section apply to all sections of Division 21.

B. Definitions:

1. Exposed: Piping and equipment exposed to view in finished rooms.
2. Option or optional: Contractor's choice of an alternate material or method.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- C. Section 07 84 00, FIRESTOPPING.
- D. Section 07 92 00, JOINT SEALANTS.
- E. Section 09 91 00, PAINTING.
- F. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.3 QUALITY ASSURANCE**

A. 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. See other specification sections for any exceptions.
2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.
3. 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.
4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
5. 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.
6. Asbestos products or equipment or materials containing asbestos shall not be used.

- B. 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 Resident Engineer 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.
- C. Guaranty: In GENERAL CONDITIONS.
- D. Extended Guarantee Period Services:
1. Qualifications: All service technicians assigned to perform work under this contract shall be qualified and factory trained by the Original Equipment Manufacturer (O.E.M.). Each technician shall have at least three years experience of working on comparable systems and shall be a full time employee of the contractor. The contractor shall furnish, for the Department of Veterans Affairs (VA) review and approval, resumes of all service technicians scheduled to service the equipment and systems. The resume shall include details of experience, training, and educational qualifications and performance evaluations.
  2. Replacement Parts: The contractor shall be equipped with all replacement parts of all equipment and systems to be serviced and the manufacturer's standard service and repair procedures. All replacement parts shall be brand new and of current design. The replacement parts shall be O.E.M. items. Obsolete or refurbished parts are unacceptable. "Approved Equal" parts must have prior approval of the Contracting Officer. Contractor shall furnish evidence of guaranteed supply of parts for the life of the system.
  3. Service Supplies: The services shall include, without any additional cost to the government, all replacement parts, special tools and equipment, and consumable materials, that is, lubrication oil, grease, and cleaning materials, as required. The requirement of UL listing, where applicable, shall not be voided by any replacement parts, components, software, or modifications provided by the contractor.
  4. Scheduled and Emergency Call Service: The service shall include a scheduled monthly visit to perform systematic examination of equipment and/or systems and a 7 day, 24 hours call back service for emergency service. The emergency service is defined as a situation created by a breakdown or malfunction of any equipment or system warranting urgent attention. A qualified service representative shall

- respond to the VA request for emergency service within two hours and assess the problem either by telephone or remote diagnostic capability. If the emergency situation cannot be rectified by the VA personnel, on site emergency service shall be provided by sending a qualified service representative within 24 hours. For the rural locations of the VA medical centers, situated over 200 miles from the contractor's established service depot, the maximum response time of 48 hours shall be acceptable. The emergency service shall be limited to adjustments and repairs specifically required to protect the safety of the equipment for which the emergency service was required to be performed.
5. Licensing: The contractor shall be licensed to perform the contracted services. The contractor shall furnish details of all applicable local and state licensing requirements to VA as a part of the qualification requirements. The licenses shall be current, valid through the term of the contract and in the name of the contractor.
  6. Documentation Requirements: The contractor shall maintain a separate log for each item of equipment and each system covered under the extended guarantee period service contract with the VA Medical Center (VAMC) Engineering Service. The log shall list dates and times of all scheduled and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency, steps taken to rectify the situations, and specific recommendations to avoid such conditions in the future.
  7. Reports: The contractor shall provide a quarterly report for the first year and twice a year for the remainder of the guarantee period for all equipment and systems serviced under the extended guarantee period contract. The report shall clearly and concisely describe the services rendered, parts replaced, and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
  8. Quality Program: The contractor shall provide a description of the quality management and control program. The description shall include a tangible proof the existence of such program, names of at least three customers who have participated in the program, and specific information showing the applicability of program to the project.

9. Training: During each scheduled service visit, the contractor shall actively involve the VAMC maintenance personnel in performing scheduled service and associated activities. The practical training during the scheduled service visits shall include parting oral and written instructions, for each specific task of the servicing contract, to the VAMC maintenance personnel who shall operate the hardware and software in accordance with the intent of the design and under direct supervision of the service contractor's qualified service technician. At the end of the first year of the service contract, the contractor shall obtain a certificate from the VAMC Engineering Service confirming completion of training to the authorized VA representatives.

E. Supports for sprinkler piping shall be in conformance with NFPA 13.

F. Supports for standpipe shall be in conformance with NFPA 14.

#### **1.4 SUBMITTALS**

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

B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.

1. Equipment and materials identification.

2. Fire-stopping materials.

3. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.

4. Wall, floor, and ceiling plates.

C. Coordination Drawings: Provide detailed layout drawings of all piping systems. Provide details of the following.

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.

D. 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.

## **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 for Testing and Materials (ASTM):
  - A36/A36M-2001.....Carbon Structural Steel
  - A575-96.....Steel Bars, Carbon, Merchant Quality, M-Grades R (2002)
  - E84-2003.....Standard Test Method for Burning Characteristics of Building Materials
  - E119-2000.....Standard Test Method for Fire Tests of Building Construction and Materials
- C. National Fire Protection Association (NFPA):
  - 90A-96.....Installation of Air Conditioning and Ventilating Systems
  - 101-97.....Life Safety Code

## **PART 2 - PRODUCTS**

### **2.1 LIFTING ATTACHMENTS**

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

### **2.2 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 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. 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.
2. 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.
3. 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.

**2.3 FIRESTOPPING**

- A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping.

**2.4 GALVANIZED REPAIR COMPOUND**

- A. Mil. Spec. DOD-P-21035B, paint form.

**2.5 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 this requirement 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.

## **2.6 TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the Resident Engineer, 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: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.
- D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

## **2.7 WALL, FLOOR AND CEILING PLATES**

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.

- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Coordinate location of piping, sleeves, inserts, hangers, and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. 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 equipment against dirt, water, chemicals, or mechanical injury. At completion of all work thoroughly exposed materials and equipment.
- C. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum.
- D. Install gages, valves, and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position 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.



E. 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.

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

G. Switchgear 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.

H. 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 LUBRICATION

A. Field check and lubricate equipment requiring lubrication prior to initial operation.

### **3.3 STARTUP AND TEMPORARY OPERATION**

- A. 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.

### **3.4 OPERATING AND PERFORMANCE TESTS**

- A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and 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.

### **3.5 INSTRUCTIONS TO VA PERSONNEL**

- A. Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

- - - E N D - - -

**SECTION 21 08 00**

**COMMISSIONING OF FIRE SUPPRESSION SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 21.
- B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING 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 Fire Suppression systems, subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00, General Commissioning Requirements.
- B. Refer to Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

**1.4 DEFINITIONS**

- A. Refer to Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS for definitions.

**1.5 COMMISSIONED SYSTEMS**

- A. Commissioning of a system or systems specified in Division 21 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 21, is required in cooperation with the VA and the Commissioning Agent.

- B. The Fire Suppression systems commissioning will include the systems listed in Section 01 91 00, General Commissioning Requirements.

#### **1.6 SUBMITTALS**

- A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES for further details.
- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION**

#### **3.1 CONSTRUCTION INSPECTIONS**

- A. Commissioning of the building fire suppression systems will require inspection of individual elements of the fire suppression construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning plan, to schedule inspections as required to support the Commissioning Process.

#### **3.2 PRE-FUNCTIONAL CHECKLISTS**

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed

checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00, GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

### **3.3 CONTRACTORS TESTS**

- A. Contractor tests as required by other sections of Division 21 shall be scheduled and documented in accordance with Section 01 00 00, GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

### **3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING**

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the 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 21 Sections for additional Contractor training requirements.

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**SECTION 21 13 13**  
**WET-PIPE SPRINKLER SYSTEMS**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. Design, installation and testing shall be in accordance with NFPA 13 except for specified exceptions.
- B. The design and installation of a hydraulically calculated automatic wet system complete and ready for operation, for all portions of Building.
- C. Modification of the existing sprinkler system as indicated on the drawings and as further required by these specifications.

**1.2 RELATED WORK**

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Section 07 84 00, FIRESTOPPING: Treatment of penetrations through rated enclosures.
- C. Section 09 91 00, PAINTING.
- D. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION.
- E. Section 28 31 00, FIRE DETECTION AND ALARM: Connection to fire alarm of flow switches, pressure switches and valve supervisory switches.

**1.3 QUALITY ASSURANCE**

- A. Installer Reliability: The installer shall possess a valid State of (Pennsylvania) fire sprinkler contractor's license. The installer shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.
- B. Materials and Equipment: All equipment and devices shall be of a make and type listed by UL and approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials, devices, and equipment shall be approved by the VA.
- C. Submittals: Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES. Prepare detailed working drawings that are signed by a NICET Level III or Level IV Sprinkler Technician or stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering. As Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide index referencing the appropriate specification section. Submittals shall include, but not be limited to, the following:

1. Qualifications:
  - a. Provide a copy of the installing contractor's fire sprinkler and state contractor's license.
  - b. Provide a copy of the NICET certification for the NICET Level III or Level IV Sprinkler Technician who prepared and signed the detailed working drawings unless the drawings are stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering.
2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to NFPA 13. Include a site plan showing the piping to the water supply test location.
3. Manufacturers Data Sheets:
  - a. For backflow preventers, provide flow test curves from UL, FM, or the Foundation for Hydraulic Research and Cross-Connection Control to verify pressure loss calculations.
  - b. Provide for materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheet describes items in addition to that item being submitted, clearly identify proposed item on the sheet.
4. Calculation Sheets: Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of NFPA 13.
5. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES. Submittals shall include, but not be limited to, the following:
  - a. One complete set of reproducible as-built drawings showing the installed system with the specific interconnections between the waterflow switch or pressure switch and the fire alarm equipment.
  - b. Complete, simple, understandable, step-by-step, testing instructions giving recommended and required testing frequency of all equipment, methods for testing all equipment, and a complete trouble shooting manual. Provide maintenance instructions on replacing any components of the system including internal parts, periodic cleaning and adjustment of the equipment and components with information as to the address and telephone number of both the manufacturer and the local supplier of each item.



- c. Material and Testing Certificate: Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a completed Material and Testing Certificate as indicated in NFPA 13.
  - d. Certificates shall document all parts of the installation.
  - e. Instruction Manual: Provide one copy of the instruction manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser.
- D. Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA 13. Recommendations in appendices shall be treated as requirements.
- 1. Perform hydraulic calculations in accordance with NFPA 13 utilizing the Area/Density method. Do not restrict design area reductions permitted for using quick response sprinklers throughout by the required use of standard response sprinklers in the areas identified in this section.
  - 2. Sprinkler Protection: To determining spacing and sizing, apply the following coverage classifications:
    - a. Light Hazard Occupancies: Patient care, treatment, and customary access areas.
    - b. Ordinary Hazard Group 1 Occupancies: Laboratories, Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, Elevator Shafts, Elevator Machine Rooms
    - c. Ordinary Hazard Group 2 Occupancies: Storage rooms, trash rooms, clean and soiled linen rooms, pharmacy and associated storage, laundry, kitchens, kitchen storage areas, retail stores, retail store storage rooms, storage areas, building management storage, boiler plants, energy centers, warehouse spaces, file storage areas for the entire area of the space up to 140 square meters (1500 square feet) and Supply Processing and Distribution (SPD).
    - d. Request clarification from the Government for any hazard classification not identified.
  - 3. Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.

4. Zoning:

- a. For each sprinkler zone provide a control valve, flow switch and a test and drain assembly with pressure gauge.
- b. Sprinkler zones shall conform to the smoke barrier zones shown on the drawings.
- c. Provide seismic protection in accordance with NFPA 13.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):  
13-2002.....Installation of Sprinkler Systems  
101-22003.....Safety to Life from Fire in Buildings and  
Structures (Life Safety Code)  
170-1999.....Fire Safety Symbols
- C. Underwriters Laboratories, Inc. (UL):  
Fire Protection Equipment Directory - 2001
- D. Factory Mutual Engineering Corporation (FM):  
Approval Guide - 2001
- E. Uniform Building Code - 1997
- F. Foundation for Cross-Connection Control and Hydraulic Research-2005

**PART 2 PRODUCTS**

**2.1 PIPING & FITTINGS**

- A. Sprinkler systems in accordance with NFPA 13. Use nonferrous piping in MRI Scanning Rooms.

**2.2 VALVES**

- A. Valves in accordance with NFPA 13.
- B. Do not use quarter turn ball valves for 50 mm (2 inch) or larger drain valves.
- C. The wet system control valve shall be a listed indicating type valve. Control valve shall be UL Listed and FM Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI. (No Substitutions Allowed).
- D. Alarm valve shall be UL Listed and Factory Mutual Approved. The alarm valve shall be equipped with a removable cover assembly. The alarm valve shall be listed for installation in the vertical or horizontal position. The alarm valve shall be equipped with gauge connections on the system side and supply side of the valve clapper. The alarm valve

shall be equipped with an external bypass to eliminate false water flow alarms. The alarm valve trim piping shall be externally galvanized. Maximum water working pressure to 250 PSI.

- E. Automatic Ball Drips: Cast brass 20 mm (3/4 inch) in-line automatic ball drip with both ends threaded with iron pipe threads.

### **2.3 FIRE DEPARTMENT SIAMESE CONNECTION**

- A. Brass, exterior fire department connection with brass escutcheon plate, and a minimum of two 65 mm (2-1/2 inch) connections threaded to match those on the local fire protection service, with polished brass caps and chains. Provide escutcheon with integral raised letters "Automatic Sprinkler" "Standpipe and Automatic Sprinkler". Install an automatic ball drip between fire department connection and check valve with drain piping routed to the exterior of the building or a floor drain.

### **2.4 SPRINKLERS**

- A. All sprinklers except "institutional" type sprinklers shall be FM approved. Provide quick response sprinklers in all areas, except where specifically prohibited by their listing or approval.
1. Cold storage rooms: Standard response dry pendant sprinklers.

### **2.5 SPRINKLER CABINET**

- A. Provide sprinkler cabinet with the required number of sprinkler heads of all ratings and types installed, and a sprinkler wrench for each system. Locate adjacent to the riser. Sprinkler heads shall be installed in center of tile or center to center.

### **2.6 IDENTIFICATION SIGNS/HYDRAULIC PLACARDS**

- A. Plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Enter pertinent data for each system on the hydraulic placard.

### **2.7 SWITCHES**

- A. Contain in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, 13 mm (1/2 inch) conduit entrance and necessary facilities for attachment to the valves. Provide two SPDT switches rated at 2.5 amps at 24 VDC.
- B. Water flow Alarm Switches: Mechanical, non-coded, non-accumulative retard and adjustable from 0 to 60 seconds minimum. Set flow switches at an initial setting between 20 and 30 seconds.

- C. Pressure Switches: Activation by any flow of water equal to or in excess of the discharge from one sprinkler. Water Flow Indicating Pressure Switch will activate an alarm by way of an alarm pressure switch. The alarm pressure switch shall be compatible with system devices. The alarm pressure enclosure shall be UL Listed and Factory Mutual Approved for the application in which it is used. The alarm pressure switch shall have the ability to be wired for Class A or Class B service.
- D. Valve Supervisory Switches for Ball and Butterfly Valves: May be integral with the valve.

## **2.8 GAUGES**

- A. Provide gauges as required by NFPA 13.

## **2.9 PIPE HANGERS AND SUPPORTS**

- A. Supports, hangers, etc., of an approved pattern placement to conform to NFPA 13. System piping shall be substantially supported to the building structure. The installation of hangers and supports shall adhere to the requirements set forth in NFPA 13, Standard for Installation of Sprinkler Systems. Materials used in the installation or construction of hangers and supports shall be listed and approved for such application. Hangers or supports not specifically listed for service shall be designed and bear the seal of a professional engineer.

## **2.10 WALL, FLOOR AND CEILING PLATES**

- A. Provide chrome plated steel escutcheon plates for exposed piping passing through walls, floors or ceilings.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- B. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template. Install concealed piping in spaces that have finished ceilings. Where ceiling mounted equipment exists, such as in operating and radiology rooms, install sprinklers so as not to obstruct the movement or operation of the equipment. Sidewall heads may need to be utilized. Locate piping in stairways as near to the ceiling as possible to prevent tampering by unauthorized personnel, and to provide

a minimum headroom clearance of 2250 mm (seven feet six inches). To prevent an obstruction to egress, provide piping clearances in accordance with NFPA 101.

- C. Welding: Conform to the requirements and recommendations of NFPA 13.
- D. Drains: Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 13.
- E. Supervisory Switches: Provide supervisory switches for sprinkler control valves.
- F. Waterflow Alarm Switches: Install waterflow switch and adjacent valves in easily accessible locations.
- G. Inspector's Test Connection: Install and supply in conformance with NFPA 13, locate in a secured area, and discharge to the exterior of the building.
- H. Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.
- I. Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA 13. Seal this space with a UL Listed through penetration fire stop material in accordance with Section 07 84 00, FIRESTOPPING. Where core drilling is used in lieu of sleeves, also seal space. Seal penetrations of walls, floors and ceilings of other types of construction, in accordance with Section 07 84 00, FIRESTOPPING.
- J. Provide pressure gauge at each water flow alarm switch location and at each main drain connection.
- K. For each fire department connection, provide the symbolic sign given in NFPA 170 and locate 2400 to 3000 mm (8 to 10 feet) above each connection location. Size the sign to 450 by 450 mm (18 by 18 inches) with the symbol being at least 350 by 350 mm (14 by 14 inches).
- L. Firestopping shall comply with Section 07 84 00, FIRESTOPPING.
- M. Securely attach identification signs to control valves, drain valves, and test valves. Locate hydraulic placard information signs at each sectional control valve where there is a zone water flow switch.
- N. Repairs: Repair damage to the building or equipment resulting from the installation of the sprinkler system by the installer at no additional expense to the Government.

- O. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the Contracting Officer. Contractor shall develop an interim fire protection program where interruptions involve in occupied spaces. Request in writing at least one week prior to the planned interruption.

### **3.2 INSPECTION AND TEST**

- A. Preliminary Testing: Flush newly installed systems prior to performing hydrostatic tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed. Hydrostatically test system, including the fire department connections, as specified in NFPA 13, in the presence of the Contracting Officers Technical Representative (COR) or his designated representative. Test and flush underground water line prior to performing these hydrostatic tests.
- B. Final Inspection and Testing: Subject system to tests in accordance with NFPA 13, and when all necessary corrections have been accomplished, advise COR/Resident Engineer to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test.

### **3.3 INSTRUCTIONS**

- A. Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system, on the dates requested by the COR/Resident Engineer.

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**SECTION 22 05 11**  
**COMMON WORK RESULTS FOR PLUMBING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section shall apply to all sections of Division 22.
- B. Definitions:
  - 1. Exposed: Piping and equipment exposed to view in finished rooms.
  - 2. Option or optional: Contractor's choice of an alternate material or method.

**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 07 84 00, FIRESTOPPING.
- E. Section 07 92 00, JOINT SEALANTS.
- F. Section 09 91 00, PAINTING.
- G. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.3 QUALITY ASSURANCE**

- A. 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. 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.
  - 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 shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, 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 Resident Engineer (RE)/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.
- 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 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 Resident Engineer 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 drawings and specifications shall be referred to the RE/COR for resolution. Written hard copies or computer files of manufacturer's installation instructions shall be provided to the RE/COR at least two weeks prior to commencing installation of any item.
  2. Complete layout drawings shall be required by Paragraph, SUBMITTALS. Construction work shall not start on any system until the layout drawings have been approved.
- E. Guaranty: Warranty of Construction, FAR clause 52.246-21.
- F. Plumbing Systems: IPC, International Plumbing Code.

#### **1.4 SUBMITTALS**

- A. Submittals 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.
- 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. Upon request by Government, lists of previous installations for selected items of equipment shall be provided. 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. Fire stopping materials.
  - 4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
  - 5. Wall, floor, and ceiling plates.
- H. 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, 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 until 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.

I. 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. Listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided.
3. The listing shall include belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

**1.5 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 RE/COR. Such replacement shall be at no additional cost 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.

B. 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), latest edition. 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 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):  
Boiler and Pressure Vessel Code (BPVC):  
SEC IX-2007.....Boiler and Pressure Vessel Code; Section IX,  
Welding and Brazing Qualifications.
- C. American Society for Testing and Materials (ASTM):  
A36/A36M-2008.....Standard Specification for Carbon Structural  
Steel  
A575-96 (R 2007).....Standard Specification for Steel Bars, Carbon,  
Merchant Quality, M-Grades R (2002)  
E84-2005.....Standard Test Method for Surface Burning  
Characteristics of Building Materials  
E119-2008a.....Standard Test Methods for Fire Tests of  
Building Construction and Materials
- D. Manufacturers Standardization Society (MSS) of the Valve and Fittings  
Industry, Inc:  
SP-58-02.....Pipe Hangers and Supports-Materials, Design and  
Manufacture  
SP 69-2003 (R 2004).....Pipe Hangers and Supports-Selection and  
Application
- E. National Electrical Manufacturers Association (NEMA):  
MG1-2003, Rev. 1-2007...Motors and Generators
- F. International Code Council, (ICC):  
IBC-06, (R 2007).....International Building Code  
IPC-06, (R 2007).....International Plumbing Code

## **PART 2 - PRODUCTS**

### **2.1 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.
- 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

### **2.2 COMPATIBILITY OF RELATED EQUIPMENT**

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

### **2.3 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 6 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.

## **2.4 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 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 shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, fans, etc. shall be identified.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 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 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: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 216 mm (8-1/2 inches) by 280 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. A copy of the valve list shall be mounted in picture frames for mounting to a wall.
  - 4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling.

## **2.5 FIRE STOPPING**

- 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 23 07 11, HVAC INSULATION, for pipe insulation.

## **2.6 GALVANIZED REPAIR COMPOUND**

- A. Mil. Spec. DOD-P-21035B, paint.

## **2.7 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), latest edition. Submittals based on the International Building Code (IBC), latest edition, or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in a state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the Resident Engineer in all cases. See these specifications for lateral force design requirements.
- B. Type Numbers Specified: 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 102 mm (4 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 (4 inches) thick when approved by the Resident Engineer for each job condition.
- D. For Attachment to Steel Construction: MSS SP-58.
1. Welded attachment: Type 22.
  2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8-inch) outside diameter.
- E. For Attachment to Wood Construction: Wood screws or lag bolts.

- F. Hanger Rods: Hot-rolled steel, ASTM A36 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.
- G. Multiple (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. Trapeze hangers are 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 13 mm (1/2-inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.
- H. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT 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, plastic coated or taped with 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. 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.

I. 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 cold water shall have insulation that extends a minimum of one 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) wear plates welded to the bottom sheet metal jacket.
5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

**2.8 PIPE PENETRATIONS**

- A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.
- B. Pipe penetration sleeve materials shall comply with all fire stopping requirements for each penetration.
- C. To prevent accidental liquid spills from passing to a lower level, provide the following:
  1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
  2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
  3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- D. Penetrations are 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.

- E. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- F. Cast iron or zinc coated pipe sleeves shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.
- G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves shall be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel Sleeve shall be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.
- H. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.
- I. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with 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.

## **2.9 TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the Resident Engineer, 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 Resident Engineer.
- 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.

## **2.10 WALL, FLOOR AND CEILING PLATES**

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3 inch) pipe, 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

## **2.11 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.

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

- B. 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 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. Maintenance and operating space and access provisions that are shown on the drawings shall not be changed nor reduced.

- C. Structural systems necessary for pipe and equipment support shall be coordinated 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. 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 RE/COR where working area space is limited.
  - 2. 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 RE/COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to RE/COR for approval.
  - 3. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.
- 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. 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. 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 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, shall be used for all pad or floor mounted equipment. 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.
- J. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.
- K. Many plumbing systems interface with the HVAC control system. See the HVAC control points list.
- L. Work in Existing Building:
  - 1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
  - 2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.
- M. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.
- N. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers putty.
- O. Switchgear 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.

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 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 Para. 3.1 shall apply.
- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. 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 RE/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 Resident Engineer.
- 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), latest edition, 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 realignment.

### **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 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application shall be provided. All materials shall be delivered to RE/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 RE/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. Inspections will be made by personnel of the VA Medical Center, and the Contractor shall follow all directives of the RE or 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. 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 RE/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.
- D. 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 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 color as utilized by the pump manufacturer
  - 5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
  - 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.

### **3.8 IDENTIFICATION SIGNS**

- A. Laminated plastic signs, with engraved lettering not less than 5 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, performance shall be placed on factory built equipment.
- C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

### **3.9 STARTUP AND TEMPORARY OPERATION**

- A. Start-up 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.

### **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 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 such systems respectively during first actual seasonal use of respective systems following completion of work.

### **3.11 OPERATION AND MAINTENANCE MANUALS**

- A. Provide four bound copies. The Operations and maintenance manuals shall be delivered to RE/COR not less than 30 days prior to completion of a phase or final inspection.
- B. All new and temporary equipment and all elements of each assembly shall be included.
- C. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.
- D. 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.
- E. Lubrication instructions, type and quantity of lubricant shall be included.
- F. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.
- G. Set points of all interlock devices shall be listed.
- H. Trouble-shooting guide for the control system troubleshooting guide shall be inserted into the Operations and Maintenance Manual.
- I. The combustion control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.
- J. Emergency procedures.

### **3.12 INSTRUCTIONS TO VA PERSONNEL**

- A. Instructions shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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**SECTION 22 07 11**  
**PLUMBING INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Field-applied insulation for thermal efficiency and condensation control for:
  - 1. Plumbing piping and equipment.
  - 2. Re-insulation of plumbing piping and equipment after asbestos abatement.
- B. Definitions
  - 1. ASJ: All service jacket, white finish facing or jacket.
  - 2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
  - 3. Cold: Equipment or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
  - 4. Concealed: Piping above ceilings and in chases, and pipe spaces.
  - 5. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, interstitial spaces, .
  - 6. FSK: Foil-scrim-kraft facing.
  - 7. Hot: Plumbing equipment or piping handling media above 41 degrees C (105 degrees F).
  - 8. Density: kg/m<sup>3</sup> - kilograms per cubic meter (Pcf - pounds per cubic foot).
  - 9. Thermal conductance: Heat flow rate through materials.
    - a. Flat surface: Watts per square meter (BTU per hour per square foot).
    - b. Pipe or Cylinder: Watts per square meter (BTU per hour per linear foot).
  - 10. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).

11. 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.
12. R: Pump recirculation.
13. CW: Cold water.
14. HW: Hot water.
15. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

## **1.2 RELATED WORK**

- A. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT: Insulation containing asbestos material.
- B. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
- C. 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.

## **1.3 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, 4.3.10.2.6, 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, unless otherwise provided for in 4.3.3.1.12 or 4.3.3.1.2, shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.

**4.3.3.1.1** Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

**4.3.3.3** Pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, Standard Test Method for Hot-



Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.

4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).

4.3.10.2.6.3 Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

4.3.10.2.6.7 Smoke detectors shall not be required to meet the provisions of this section.

2. Test methods: ASTM E84, UL 723, or NFPA 255.

3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.

4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

#### **1.4 SUBMITTALS**

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

B. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.

a. Insulation materials: Specify each type used and state surface burning characteristics.

b. Insulation facings and jackets: Each type used.

c. Insulation accessory materials: Each type used.

- d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
  - e. Make reference to applicable specification paragraph numbers for coordination.
- C. Samples:
- 1. Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/ blanket; 150 mm (6 inches) long, full diameter for round types.
  - 2. Each type of facing and jacket: Minimum size 100 mm (4 inches square).
  - 3. Each accessory material: Minimum 120 ML (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives / cement / mastic.

#### **1.5 STORAGE AND HANDLING OF MATERIAL**

- A. Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Federal Specifications (Fed. Spec.):
  - L-P-535E (2)-91.....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):

- A167-04 .....Standard Specification for Stainless and  
Heat-Resisting Chromium-Nickel Steel Plate,  
Sheet, and Strip
- 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
- C449-07.....Standard Specification for Mineral Fiber  
Hydraulic-Setting Thermal Insulating and  
Finishing Cement
- 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
- C547-07 .....Standard Specification for Mineral Fiber pipe  
Insulation
- C552-07 .....Standard Specification for Cellular Glass  
Thermal Insulation
- C553-08 .....Standard Specification for Mineral Fiber  
Blanket Thermal Insulation for Commercial and  
Industrial Applications
- C585-09.....Standard Practice for Inner and Outer Diameters  
of Rigid Thermal Insulation for Nominal Sizes  
of Pipe and Tubing (NPS System) R (1998)
- C612-10 .....Standard Specification for Mineral Fiber Block  
and Board Thermal Insulation
- C1126-10.....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
- E119-09C.....Standard Test Method for Fire Tests of Building  
Construction and Materials
- E136-09 b.....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 08/03
- G. Manufacturer's Standardization Society of the Valve and Fitting  
Industry (MSS):
- SP58-2002.....Pipe Hangers and Supports Materials, Design,  
and Manufacture

## **PART 2 - PRODUCTS**

### **2.1 MINERAL FIBER OR FIBER GLASS**

- A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m<sup>3</sup> (3 pcf), k = 0.037 (.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).
- B. ASTM C553 (Blanket, Flexible) Type I, Class B-3, Density 16 kg/m<sup>3</sup> (1 pcf), k = 0.045 (0.31) at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F)
- C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

## **2.2 MINERAL WOOL OR REFRACTORY FIBER**

- A. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees F).

## **2.3 RIGID CELLULAR PHENOLIC FOAM**

- A. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1,  $k = 0.021(0.15)$  at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with vapor retarder and all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.
- B. Equipment Insulation, ASTM C 1126, type II, grade 1,  $k = 0.021 (0.15)$  at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket.

## **2.6 FLEXIBLE ELASTOMERIC CELLULAR THERMAL**

- A. ASTM C177, C518,  $k = 0.039 (0.27)$  at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

## **2.7 CALCIUM SILICATE**

- A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- B. Premolded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- C. Equipment Insulation: ASTM C533, Type I and Type II

D. Characteristics:

Insulation Characteristics		
ITEMS	TYPE I	TYPE II
Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m <sup>3</sup> (lb/ ft <sup>3</sup> )	232 (14.5)	288 (18)
Thermal conductivity: Min W/ m K (Btu in/h ft <sup>2</sup> degrees F)@ mean temperature of 93 degrees C (200 degrees F)	0.059 (0.41)	0.078 (0.540)
Surface burning characteristics: Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

**2.9 PIPE COVERING PROTECTION SADDLES**

- A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m<sup>3</sup> (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

- B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m<sup>3</sup> (3.0 pcf).

## **2.10 ADHESIVE, MASTIC, CEMENT**

- A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
- B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.
- C. Mil. Spec. MIL-A-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.

## **2.11 MECHANICAL FASTENERS**

- A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching galvanized steel
- 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 (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

## **2.12 REINFORCEMENT AND FINISHES**

- A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
- B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.
- C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.
- E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.

- F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

## **2.13 FIRESTOPPING MATERIAL**

- A. Other than pipe insulation, refer to Section 07 84 00 FIRESTOPPING.

## **2.14 FLAME AND SMOKE**

- A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

# **PART 3 - EXECUTION**

## **3.1 GENERAL REQUIREMENTS**

- A. Required pressure tests of piping joints and connections shall be completed and the work approved by the 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 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 in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).



- E. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.
- F. Construct insulation on parts of equipment such as 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.
- G. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- H. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.
- I. Plumbing work not to be insulated:
  - 1. Piping and valves of fire protection system.
  - 2. Chromium plated brass piping.
  - 3. Water piping in contact with earth.
  - 4. Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).
  - 5. Distilled water piping.
- J. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.
- K. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights.  
Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

L. Firestop Pipe insulation:

1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.
2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
  - a. Pipe risers through floors
  - b. Pipe chase walls and floors
  - c. Smoke partitions
  - d. Fire partitions

M. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (0.75) thick insulation, for all pipe sizes 75 mm(3 inches) and smaller and 25 mm(1inch) thick insulation for larger pipes. Provide metal jackets for all pipes. Provide for cold water make-up where indicated on the drawings as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).

N. Provide vapor barrier jackets over insulation as follows:

1. All piping exposed to outdoor weather.
2. All interior piping conveying fluids //exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces, etc.) below ambient air temperature in high humidity areas /.

O. Provide metal jackets over insulation as follows:

- a. All plumbing piping exposed to outdoor weather.
- b. Piping exposed in building, within 1800 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
- c. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

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### 3.2 INSULATION INSTALLATION

#### A. Mineral Fiber Board:

1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
2. Plain board:
  - a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
  - b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.
  - c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
3. Cold equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
  - a. Water filter, chemical feeder pot or tank.
  - b. Pneumatic, cold storage water and surge tanks.
4. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
  - a. Domestic water heaters and hot water storage tanks (not factory insulated).
  - b. Booster water heaters for dietetics dish and pot washers and for washdown grease-extracting hoods.

B. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe, aligning 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.

C. Rigid Cellular Phenolic Foam:

1. Rigid closed cell phenolic insulation may be provided for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
2. Note the NFPA 90A burning characteristics requirements of 25/50 in paragraph 1.3.B
3. Provide secure attachment facilities such as welding pins.
4. Apply insulation with joints tightly drawn together
5. Apply adhesives, coverings, neatly finished at fittings, and valves.
6. Final installation shall be smooth, tight, neatly finished at all edges.
7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.
8. Condensation control insulation: Minimum 25 mm (1.0 inch) thick for all pipe sizes.
  - a. Plumbing piping as follows:
    - 1) Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.
    - 2) Waste piping from electric water coolers and icemakers to drainage system.
    - 3) Reagent grade water piping.
    - 4) Cold water piping.

D. Cellular Glass Insulation:

1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.
2. Underground Piping Other than or in lieu of that Specified in Section 22 11 00, FACILITY WATER DISTRIBUTION: Type II, factory jacketed with a 3 mm laminate jacketing consisting of 3000 mm x 3000 mm (10 ft x 10 ft) asphalt impregant<sup>4</sup>ed glass fabric, bituminous mastic and outside protective plastic film.
  - a. 75 mm (3 inches) thick for hot water piping.
  - b. As scheduled at the end of this section for chilled water piping.
  - c. Underground piping: Apply insulation with joints tightly butted. Seal longitudinal self-sealing lap. Use field fabricated or factory made fittings. Seal butt joints and fitting with

jacketing as recommended by the insulation manufacturer. Use 100 mm (4 inch) wide strips to seal butt joints.

- d. Provide expansion chambers for pipe loops, anchors and wall penetrations as recommended by the insulation manufacturer.
  - e. Underground insulation shall be inspected and approved by the Resident Engineer as follows:
    - 1) Insulation in place before coating.
    - 2) After coating.
  - f. Sand bed and backfill: Minimum 75 mm (3 inches) all around Insulated pipe or tank, applied after coating has dried.
3. Cold equipment: 50 mm (2 inch) thick insulation faced with ASJ.
- E. Polyisocyanurate Closed-Cell Rigid Insulation:
- 1. Polyisocyanurate closed-cell rigid insulation (PIR) may be provided for exterior piping and equipment for temperature up to 149 degree C (300 degree F.
  - 2. Install insulation, vapor retarder and jacketing per manufacturer's recommendations. Particular attention should be paid to recommendations for joint staggering, adhesive application, external hanger design, expansion/contraction joint design and spacing and vapor retarder integrity.
  - 3. Install insulation with all joints tightly butted (except expansion joints in hot applications).
  - 4. If insulation thickness exceeds 63 mm (2.5 inches), install as a double layer system with longitudinal (lap) and butt joint staggering as recommended by manufacturer.
  - 5. For cold applications, vapor retarder shall be installed in a continuous manner. No staples, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall be used to attach the vapor retarder or jacketing. No wire ties capable of penetrating the vapor retarder shall be used to hold the insulation in place. Banding shall be used to attach PVC or metal jacketing.

6. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill PVC elbow jacket is prohibited on cold applications.
7. For cold applications, the vapor retarder on elbows/fittings shall be either mastic-fabric-mastic or 2 mil thick PVDC vapor retarder adhesive tape.
8. All PVC and metal jacketing shall be installed so as to naturally shed water. Joints shall point down and shall be sealed with either adhesive or caulking (except for periodic slip joints).
9. Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph 1.3B. Refer to paragraph 3.1 for items not to be insulated.
10. Minimum thickness in millimeter (inches) specified in the schedule at the end of this section.

F. Flexible Elastomeric Cellular Thermal Insulation:

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
2. Pipe and tubing insulation:
  - a. Use proper size material. Do not stretch or strain insulation.
  - b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
  - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.

3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.

G. Calcium Silicate:

1. Minimum thickness in millimeter (inches) specified below for piping other than in boiler plant.

Nominal Thickness Of Calcium Silicate Insulation (Non-Boiler Plant)				
Nominal Pipe Size Millimeters (Inches)	Thru 25 (1)	32 to 75 (1-1/4 to 3)	100-200 (4 to 6)	Over 200 (6)
93-260 degrees C(200- 500 degrees F)(HPS, HPR)	100(4)	125(5)	150(6)	150(6)

2. MRI Quench Vent Insulation: Type I, class D, 150 mm (6 inch) nominal thickness.

**3.3 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of section 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS 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 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS and related sections for contractor responsibilities for system commissioning.



### 3.4 PIPE INSULATION SCHEDULE

Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	Insulation Material	Less than 25 (1)	25 - 32 (1 - 1¼)	38 - 75 (1½ - 3)	100 (4) and Above
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Rigid Cellular Phenolic Foam (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Polyiso-cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	----	----
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	----	----

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**SECTION 22 11 00**  
**FACILITY WATER DISTRIBUTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

**1.2 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures  
B. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.  
C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.  
D. Section 23 07 11, HVAC INSULATION.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.  
B. Manufacturer's Literature and Data:  
1. All items listed in Part 2 - Products.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.  
B. American National Standards Institute (ANSI):  
American Society of Mechanical Engineers (ASME): (Copyrighted Society)  
A13.1-2007.....Scheme for Identification of Piping Systems  
B16.3-2006.....Malleable Iron Threaded Fittings Classes 150 and 300  
B16.9-2007..... Gray Iron Threaded Fittings Classes 125 and 250  
B16.9-2007.....Factory-Made Wrought Butt Welding Fittings  
ANSI/ASME  
B16.11-2009.....Forged Fittings, Socket-Welding and Threaded  
ANSI/ASME  
B16.12-2009 .....Cast Iron Threaded Drainage Fittings ANSI/ASME  
B16.15-2006 .....Cast Bronze Threaded Fittings Classes 125 and 250 ANSI/ASME  
B16.18-01 (R2005).....Cast Copper Alloy Solder-Joint Pressure Fittings ANSI/ASME

B16.22-01 (R2005).....Wrought Copper and Copper Alloy Solder Joint  
Pressure Fittings ANSI/ASME Element ANSI/ASME  
NSF/ANSI 61.....Drinking Water System Components - Health  
Effects

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

A47/A47M-99(2009).....Ferritic Malleable Iron Castings Revision 1989  
A53/A53M-07.....Pipe, Steel, Black And Hot-Dipped, Zinc-coated  
Welded and Seamless  
A183-03(2009).....Carbon Steel Track Bolts and Nuts  
A269-10.....Standard Specification for Seamless and Welded  
Austenitic Stainless Steel Tubing for General  
Service  
A312/A312M-09.....Seamless, Welded, and Heavily Cold Worked  
Austenitic Stainless Steel Pipes  
A403/A403M-10a.....Standard Specification for Wrought Austenitic  
Stainless Steel Piping Fittings  
A536-84(2009).....Ductile Iron Castings  
A733-03(2009).....Welded and Seamless Carbon Steel and Austenitic  
Stainless Steel Pipe Nipples  
B32-08.....Solder Metal  
B61-08.....Steam or Bronze Castings  
B62-09.....Composition Bronze or Ounce Metal Castings  
B75-02.....Seamless Copper Tube  
B88-09.....Seamless Copper Water Tube  
B300-10.....AWWA Standard for Hypochlorites  
B301-10.....AWWA Standard for Liquid Chlorine  
B584-09a.....Copper Alloy Sand Castings for General  
Applications Revision A  
B687-99(2005) e1.....Brass, Copper, and Chromium-Plated Pipe Nipples  
D1785-06.....Standard Specification for Poly (Vinyl  
Chloride) (PVC) Plastic Pipe, Schedules 40, 80,  
and 120  
D2000-08.....Rubber Products in Automotive Applications  
D4101-09.....Propylene Plastic Injection and Extrusion  
Materials  
D2447-03.....Polyethylene (PE) Plastic Pipe, Schedule 40 and  
80, Based on Outside Diameter

- D2564-04(2009) e1.....Solvent Cements for Poly (Vinyl Chloride) (PVC)  
Plastic Pipe and Fittings
- D4101-09.....Propylene Plastic Injection and Extrusion  
Materials
- E1120-08.....Standard Specification For Liquid Chlorine
- E1229-08.....Standard Specification For Calcium Hypochlorite
- D. American Water Works Association (AWWA):
- C110-08.....Ductile Iron and Gray Iron Fittings - 75 mm  
thru 1200 mm (3 inch thru 48 inches) for Water  
and other liquids AWWA/ANSI
- C151/A21.51-09.....Ductile-Iron Pipe, Centrifugally Cast in Metal  
Molds or Sand-Lined Molds, for Water or Other  
Liquids AWWA/ ANSI
- C153/A21.53-06.....AWWA Standard for Ductile-Iron Compact Fittings  
for Water Service AWWA/ANSI
- C203-08.....Coal-Tar Protective Coatings and Linings for  
Steel Water Pipelines - Enamel and Tape - Hot  
Applied AWWA/ANSI
- C213-07.....Fusion Bonded Epoxy Coating For The Interior &  
Exterior Of Steel Water Pipelines
- C651-05.....Disinfecting Water Mains
- E. American Welding Society (AWS):
- A5.8/A5.8M:2004.....Filler Metals for Brazing
- F. International Plumbing Code  
International Plumbing Code - 2009
- G. American Society of Sanitary Engineers (ASSE):
- ANSI/ASSE (Plumbing)
- 1001-2008.....Pipe Applied Atmospheric Type Vacuum Breakers
- ANSI/ASSE 1010-2004.....Water Hammer Arresters
- ANSI/ASSE 1018-2001.....Performance for trap seal primer valves -  
potable water supplied.
- ANSI/ASSE (Plumbing)
- 1020-2004.....Pressure Vacuum Breaker Assembly
- H. Plumbing and Drainage Institute (PDI):
- PDI WH-201 2007.....Water Hammer Arrestor

### **1.5 QUALITY ASSURANCE**

- A. Submit prior to welding of steel piping a certificate of Welder's certification. The certificate shall be current and more than one year old.
- B. For mechanical pressed sealed fittings, only tools of fitting manufacture shall be used.
- C. Mechanical pressed fittings shall be installed by factory trained workers.
- D. 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.
- E. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

### **1.6 SPARE PARTS**

- A. For mechanical pressed sealed fittings provide tools required for each pipe size used at the facility.

## **PART 2 - PRODUCTS**

### **2.2 ABOVE GROUND (INTERIOR) WATER PIPING**

- A. Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipe 150 mm (6 inches) and larger, stainless, steel ASTM A312, schedule 10 may be used.
- B. Fittings for Copper Tube:
  - 1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP72 & 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 C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
  - 3. Mechanical press sealed fittings, 65 mm (2-1/2") in size and smaller. Fittings shall be double pressed type NSF/ANSI 61 approved and utilize EPDM (Ethylene Propylene Diene Monomer) non toxic synthetic rubber sealing elements.

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 insure 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.

C. Fittings for Stainless Steel:

1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ANSI B16.9.
2. Grooved fittings, stainless steel, Type 316, Schedule 10, conforming to ASTM A403. Segmentally fabricated fittings are not allowed. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or Malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

D. Adapters: Provide adapters for joining screwed pipe to copper tubing.

E. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.

F. Brazing alloy: AWS A5.8, Classification BCuP.

**2.3 EXPOSED WATER PIPING**

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

1. Pipe: Fed. Spec. WW-P-351, standard weight.
2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish, (125 and 250).
3. Nipples: ASTM B 687, Chromium-plated.
4. Unions: MSS SP-72, 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.

## **2.9 WATER HAMMER ARRESTER:**

A. Closed copper tube chamber with permanently sealed 410 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N O-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements (PDI WH 201). Provide water hammer arrestors at:

1. All solenoid valves.
2. All groups of two or more flush valves.
3. All quick opening or closing valves.
4. All medical washing equipment.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

A. General: Comply with the International Plumbing Code and the following:

1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
3. All pipe runs shall be laid out to avoid interference with other work.
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 International Plumbing Code, Chapter No. 3.
  - b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with red lead or 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 unplated 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) Riser Clamps: Malleable iron or steel.
  - 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 (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.
  - 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 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.
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. Fire Stopping: 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 fire stopping 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.
- B. Piping shall conform to the following:
  - 1. Domestic Water:
    - a. 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.
    - b. 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.
- 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 690 kPa (100 psi) 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.
- C. Reagent Grade Water Systems: Fill system with water and maintain hydrostatic pressure of 690 kPa (100 psi) gage during inspection and prove tight.
- D. All Other Piping Tests: Test new installed piping under 1 1/2 times actual operating conditions and prove tight.

### **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 hypochlorites for sterilization.

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**SECTION 22 13 00**  
**FACILITY SANITARY AND VENT PIPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section pertains to sanitary sewer and vent systems, including piping, equipment and all necessary accessories as designated in this section.

**1.2 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.  
B. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.  
C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.  
D. Section 23 07 11, HVAC INSULATION: Pipe Insulation.  
E. Section 07 92 00, JOINT SEALANTS: Sealant products.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.  
B. Manufacturer's Literature and Data:  
1. Piping.  
2. Floor Drains.  
3. Grease Removal Unit.  
4. Cleanouts.  
5. All items listed in Part 2 - Products.  
C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.  
B. American Society of Mechanical Engineers (ASME): (Copyrighted Society)  
A112.6.3-01 (R 2007)....Standard for Floor and Trench Drains  
A13.1-07.....Scheme for Identification of Piping Systems  
B16.3-06.....Malleable Iron Threaded Fittings, Classes 150 and 300.

B16.4-06.....Standard for Grey Iron Threaded Fittings  
Classes 125 and 250

B16.12-98 (R 2006).....Cast Iron Threaded Drainage Fittings

B16.15-06.....Cast Bronze Threaded Fittings, Classes 125 and  
250

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

A47/A47M-99 (R 2004)....Standard Specification for Steel Sheet,  
Aluminum Coated, by the Hot Dip Process

A53/A53M-07.....Standard Specification for Pipe, Steel, Black  
And Hot-Dipped, Zinc-coated, Welded and  
Seamless

A74-06.....Standard Specification for Cast Iron Soil Pipe  
and Fittings

A183-03.....Standard Specification for Carbon Steel Track  
Bolts and Nuts

A536-84(R 2004).....Standard Specification for Ductile Iron  
Castings

B32-08.....Standard Specification for Solder Metal

B75-02.....Standard Specification for Seamless Copper Tube

B306-02.....*Standard Specification for Copper Drainage Tube*  
(DWV)

B584-06a.....Standard Specification for Copper Alloy Sand  
Castings for General Applications

C564-03a.....Standard Specification for Rubber Gaskets for  
Cast Iron Soil Pipe and Fittings

D2000-08.....Standard Classification System for Rubber  
Products in Automotive Applications

D2564-04E1.....Standard Specification for Solvent Cements for  
Poly (Vinyl Chloride) (PVC) Plastic Pipe and  
Fittings

D2665-08.....*Standard Specification for Poly (Vinyl*  
*Chloride) (PVC) Plastic Drain, Waste, and Vent*  
*Pipe and Fittings*

D. International Code Council:

IPC-06.....International Plumbing Code

E. Cast Iron Soil Pipe Institute (CISPI):

301-05.....Hubless Cast Iron Soil Pipe and Fittings for  
Sanitary and Storm Drain, Waste, and Vent  
Piping Applications

310-04.....Coupling for Use in Connection with Hubless  
Cast Iron Soil Pipe and Fittings for Sanitary  
and Storm Drain, Waste, and Vent Piping  
Applications

F. American Society of Sanitary Engineers (ASSE):

1018-01.....Trap Seal Primer Valves - Potable, Water  
Supplied

G. Plumbing and Drainage Institute (PDI):

PDI WH-201.....Water Hammer Arrestor

**PART 2 - PRODUCTS**

**2.1 SANITARY WASTE, DRAIN AND VENT PIPING**

A. Cast iron waste, drain, and vent pipe and fittings

1. Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:
  - a. pipe buried in or in contact with earth
  - b. sanitary pipe extensions to a distance of approximately 1500 mm (5 feet) outside of the building.
  - c. interior waste and vent piping above grade.
2. Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).
3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301, ASTM A-888, or ASTM A-74.
4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM Standard C-564 or be installed with lead and oakum.

**B. Copper Tube, (DWV):**

1. Copper DWV tube sanitary waste, drain and vent pipe may be used for piping above ground, except for urinal drains.
2. The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.
3. The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME 16.29.
4. The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.

**2.2 EXPOSED WASTE PIPING**

A. Full iron pipe size chrome plated brass piping shall be used in finished rooms for exposed waste piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.

1. The Pipe shall meet Fed. Spec. WW-P-351, standard weight.
2. The Fittings shall conform to ANSI B16.15, cast bronze threaded fittings with chrome finish, (125 and 250).
3. Nipples shall conform to ASTM B 687, Chromium-plated.
4. Unions shall be brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

B. In unfinished Rooms such as mechanical Rooms and Kitchens, Chrome-plated brass piping is not required. The pipe materials specified under the paragraph "Sanitary Waste, Drain, and Vent Piping" can be used. The sanitary pipe in unfinished rooms shall be painted as specified in Section 09 91 00, PAINTING.

**2.3 SPECIALTY PIPE FITTINGS**

A. Transition pipe couplings shall join piping with small differences in outside diameters or different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear and corrosion resistant metal, tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:

1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.

2. For PVC soil pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F 477 or ASTM D5926.
  3. For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.
- B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 860 kPa (125 psig) at a minimum temperature of 82°C (180°F). The end connection shall be solder joint copper alloy and threaded ferrous.
- C. Dielectric flange insulating kits shall be of non conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.
- D. The di-electric nipples shall be electroplated steel nipple complying with ASTM F 1545 with a pressure ratings of 2070 kPa (300 psig) at 107°C (225°F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

#### **2.4 CLEANOUTS**

- A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); and not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged sanitary line.
- B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be

provided. Two way cleanouts shall be provided where indicated on drawings and at every building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty type.

- C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) shall be furnished at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.
- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

## **2.6 TRAPS**

A. Traps shall be provided on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints are not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

## **2.9 WATERPROOFING**

- A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting



that will extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.

B. Walls: See detail shown on drawings.

### **PART 3 - EXECUTION**

#### **3.1 PIPE INSTALLATION**

- A. The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.
- B. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
- C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
- D. All pipe runs shall be laid out to avoid interference with other work.
- E. The piping shall be installed above accessible ceilings where possible.
- F. The piping shall be installed to permit valve servicing or operation.
- G. Unless specifically indicated on the drawings, the minimum slope shall be 2% slope.
- H. The piping shall be installed free of sags and bends.
- I. Seismic restraint shall be installed where required by code.
- J. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- K. Buried soil and waste drainage and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.
- L. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"
- M. Aboveground copper tubing shall be installed according to CDA's "Copper Tube Handbook".
- N. Aboveground PVC piping shall be installed according to ASTM D2665. Underground PVC piping shall be installed according to ASTM D2321.

### **3.2 JOINT CONSTRUCTION**

- A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- C. Hubless or No-hub, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.
- D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
  - 2. Pipe sections with damaged threads shall be replaced with new sections of pipe.
- E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.

- F. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

### **3.3 SPECIALTY PIPE FITTINGS**

- A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.
- B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

### **3.3 PIPE HANGERS, SUPPORTS AND ACCESSORIES:**

- A. All piping shall be supported according to the International Plumbing Code (IPC), Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications. Where conflicts arise between these the code and Section 22 05 11, the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.
- B. Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
- C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.
- D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
  2. 80 mm or DN 80 (NPS 3 inch): 1500 mm (60 inches) with 13 mm (1/2 inch) rod.
  3. 100 mm or DN100 to 125 mm or DN125 (NPS 4 to NPS 5): 1500 mm (60 inches) with 16 mm (5/8 inch) rod.
  4. 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 19 mm (3/4 inch) rod.
  5. 250 mm or DN250 to 300 mm or DN 300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 22 mm (7/8 inch) rod.
- E. The maximum spacing for plastic pipe shall be 1.22 m (4 feet).
- F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).

- G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:
1. Solid or split unplated cast iron.
  2. All plates shall be provided with set screws.
  3. Height adjustable clevis type pipe hangers.
  4. Adjustable floor rests and base flanges shall be steel.
  5. Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
  7. Riser clamps shall be malleable iron or steel.
  8. Rollers shall be cast iron.
  9. See Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, for requirements on insulated pipe protective shields at hanger supports.
- H. Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.
- I. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- J. Penetrations:
1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
  2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

K. Piping shall conform to the following:

1. Waste and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
80 mm or DN 80 (3 inches) and smaller	2%
100 mm or DN 100 (4 inches) and larger	1%

2. Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

### 3.4 TESTS

A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.

B. Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

1. If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

2. For an air test, an air pressure of 35 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the air test.

3. After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.

4. Final Tests: Either one of the following tests may be used.
  - a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.
  - b. Peppermint Test: Introduce (2 ounces) of peppermint into each line or stack.

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**SECTION 22 40 00**  
**PLUMBING FIXTURES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

**1.2 RELATED WORK**

- A. Sealing between fixtures and other finish surfaces: Section 07 92 00, JOINT SEALANTS.
- B. Flush panel access doors: Section 08 31 13, ACCESS DOORS AND FRAMES.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Submit plumbing fixture information in an assembled brochure, showing cuts and full detailed description of each fixture.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standard Institute (ANSI):  
The American Society of Mechanical Engineers (ASME):  
A112.6.1M-02(R2008).....Floor Affixed Supports for Off-the-Floor  
Plumbing Fixtures for Public Use  
A112.19.1M-08 .....Enameled Cast Iron Plumbing Fixtures  
A112.19.2M-03.....Vitreous China Plumbing Fixtures  
A112.19.3-2001(R2008)...Stainless Steel Plumbing Fixtures (Designed for  
Residential Use)
- C. American Society for Testing and Materials (ASTM):  
A276-2010 .....Stainless and Heat-Resisting Steel Bars and  
Shapes  
WW-P-541-E/GEN .....Plumbing Fixtures with Amendment 1
- D. National Association of Architectural Metal Manufacturers (NAAMM): NAAMM  
AMP 500-505  
Metal Finishes Manual (1988)

- E. American Society of Sanitary Engineers (ASSE):  
1016-05.....Performance Requirements for Individual  
Thermostatic, Pressure Balancing and Combination  
Pressure Balancing and Thermostatic Control  
Valves for Individual Fixture Fittings
- F. National Sanitation Foundation (NSF)/American National Standards  
Institute (ANSI):  
61-2009 .....Drinking Water System Components-Health Effects
- G. American with Disabilities Act (A.D.A) Section 4-19.4 Exposed Pipes and  
Surfaces
- H. Environmental Protection Agency EPA PL 93-523 1974; A 1999) Safe  
Drinking Water Act.
- I. International Building Code, ICC IPBC 2009.

## **PART 2 - PRODUCTS**

### **2.1 STAINLESS STEEL**

- A. Corrosion-resistant Steel (CRS):
  - 1. Plate, Sheet and Strip: CRS flat products shall conform to chemical composition requirements of any 300 series steel specified in ASTM A276.
  - 2. Finish: Exposed surfaces shall have standard polish (ground and polished) equal to NAAMM finish Number 4.
- B. Die-cast zinc alloy products are prohibited.

### **2.2 STOPS**

- A. Provide lock-shield loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in wood and metal casework, laboratory furniture and pharmacy furniture. Locate stops centrally above or below fixture in accessible location.
- B. Furnish keys for lock shield stops to Resident Engineer.
- C. Supply from stops not integral with faucet shall be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.
- D. Supply pipe from wall to valve stop shall be rigid threaded IPS copper alloy pipe, i.e. red brass pipe nipple, chrome plated where exposed.
- E. Psychiatric Area: Provide stainless steel drain guard for all lavatories not installed in casework.



### **2.3 ESCUTCHEONS**

- A. Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

### **2.4 LAMINAR FLOW CONTROL DEVICE**

- A. Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing.
- B. Flow Control Restrictor:
  - 1. Capable of restricting flow from 95 ml/s to 110 ml/s (1.5 gpm to 1.7 gpm) for lavatories; 125 ml/s to 140 ml/s (2.0 gpm to 2.2 gpm) for sinks P-505 through P-520, P-524 and P-528; and 170 ml/s to 190 ml/s (2.75 gpm to 3.0 gpm) for dietary food preparation and rinse sinks or as specified.
  - 2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 170 kPa and 550 kPa (25 psi and 80 psi).
  - 3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-cleaning action, and is capable of easy manual cleaning.

### **2.5 LAVATORIES**

- A. (S-1) Sink (CRS, Single Compartment =, Wall Hung, Foot Pedal Control) with right or left hand drainboard as shown on the drawings, 14 gage CRS, one-piece approximately 1067 mm by 508 mm (42 inches by 20 inches) with 432 mm by 432 mm (17 inches by 17 inches) by 152mm (6 inches) deep sink and 102 mm (4 inches) back splash. Provide rolled rim on front and ends. Corners and edges shall be well rounded. Support sink with 10 gage CRS brackets on ASME/ANSI A112.6.1M, Type I, on chair carrier and secure fixture with minimum 10 mm (3/8 inch) all-thread bracket studs and nuts. Set rim of sink 914 mm (36 inches) above finished floor. Provide valve plate for foot pedal control.
  - 1. Drain: Stainless steel stamped drain fitting with 114 mm (4 1/2 inches) top and 76 mm (3 inches) perforated grid strainer.
  - 2. Trap: Cast copper alloy, 38 mm (1 1/2 inches) P-trap, adjustable with connected elbow and nipple to wall and escutcheon.
  - 3. Faucets: Solid brass construction, single rigid gooseneck spout with outlet 127 mm to 203 mm (5 inches to 8 inches) above flood rim of sink. Provide laminar flow control device. Wall mounted, mechanical

pedal mixing valve with self-closing pedal valve with stops, renewable seats, and supply from valve to spout, indexed lift up pedals having clearances of not more than 13 mm (1/2 inch) above the floor and not less than 356 mm (14 inches) from wall when in operation. Supply pipe from wall to valve stop shall be rigid threaded IPS copper alloy pipe. Supply pipe from valve to faucet shall be manufacturer's option. Exposed brass parts shall be chrome plated with a smooth bright finish.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section 07 92 00, JOINT SEALANTS.
- B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.
- C. Through Bolts: For free standing marble and metal stud partitions.
- D. Toggle Bolts: For hollow masonry units, finished or unfinished.
- E. Expansion Bolts: For brick or concrete or other solid masonry. Shall be 6 mm (1/4 inch) diameter bolts, and to extend at least 76 mm (3 inches) into masonry and be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.
- F. Power Set Fasteners: May be used for concrete walls, shall be 6 mm (1/4 inch) threaded studs, and shall extend at least 32 mm (1 1/4 inches) into wall.
- G. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.
- H. Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.
- I. Do not use aerators on lavatories and sinks.

#### **3.2 CLEANING**

- A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

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**SECTION 23 05 11  
COMMON WORK RESULTS FOR HVAC**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 23.
- 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. COR: Contracting Officer's Representative.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- D. Section 07 84 00, FIRESTOPPING.
- F. Section 07 92 00, JOINT SEALANTS.
- G. Section 09 91 00, PAINTING.
- H. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC.
- I. Section 23 07 11, HVAC INSULATION.
- J. Section 23 23 00, REFRIGERANT PIPING.
- K. Section 23 31 00, HVAC DUCTS and CASINGS.
- L. Section 23 34 00, HVAC FANS.
- M. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT.
- N. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training
- O. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**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. 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.

C. 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.

- D. 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.
- E. 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.
- F. 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. 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.
  - 4. Fire-stopping materials.
  - 5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
  - 6. Wall, floor, and ceiling plates.
- G. 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.
- H. 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
- G. American Society for Testing and Materials (ASTM):  
A36/A36M-08.....Standard Specification for Carbon Structural  
Steel  
A575-96(2007).....Standard Specification for Steel Bars, Carbon,  
Merchant Quality, M-Grades  
E84-10.....Standard Test Method for Surface Burning  
Characteristics of Building Materials  
E119-09c.....Standard Test Methods for Fire Tests of  
Building Construction and 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

85-07.....Boiler and Combustion Systems Hazards Code

90A-09.....Standard for the Installation of Air  
Conditioning and Ventilating Systems

101-09.....Life Safety 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. 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.

## **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**

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

### 2.3 BELT DRIVES

- A. Type: ANSI/RMA standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.
- B. Dimensions, rating and selection standards: ANSI/RMA IP-20 and IP-21.
- C. Minimum Horsepower Rating: Motor horsepower plus recommended ANSI/RMA service factor (not less than 20 percent) in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact.
- D. Maximum Speed: 25 m/s (5000 feet per minute).
- E. Adjustment Provisions: For alignment and ANSI/RMA standard allowances for installation and take-up.
- F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.
- G. Multiple Belts: Matched to ANSI/RMA specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.
- H. Sheaves and Pulleys:
  - 1. Material: Pressed steel, or close grained cast iron.
  - 2. Bore: Fixed or bushing type for securing to shaft with keys.
  - 3. Balanced: Statically and dynamically.
  - 4. Groove spacing for driving and driven pulleys shall be the same.
- I. Drive Types, Based on ARI 435:
  - 1. Provide adjustable-pitch //or fixed-pitch// drive as follows:
    - a. Fan speeds up to 1800 RPM: 7.5 kW (10 horsepower) and smaller.
    - b. Fan speeds over 1800 RPM: 2.2 kW (3 horsepower) and smaller.
  - 2. Provide fixed-pitch drives for drives larger than those listed above.
  - 3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

## **2.4 DRIVE GUARDS**

- A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor to prevent damage to equipment and injury to personnel. Drive guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.
- B. V-belt and sheave assemblies shall be totally enclosed, firmly mounted, non-resonant. Guard shall be an assembly of minimum 22-gage sheet steel and expanded or perforated metal to permit observation of belts. 25 mm (one-inch) diameter hole shall be provided at each shaft centerline to permit speed measurement.
- C. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.
- D. Access for Speed Measurement: 25 mm (One inch) diameter hole at each shaft center.

## **2.5 ELECTRIC MOTORS**

- A. All material and equipment furnished and installation methods shall conform to the requirements of Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC EQUIPMENT and Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient premium efficiency type motors as scheduled.

## **2.6 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. 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.
- B. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.
- 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. 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.
2. 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.
3. 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.

**2.7 FIRESTOPPING**

- A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer to Section 23 07 11, HVAC INSULATION, for firestop pipe and duct insulation.

**2.8 GALVANIZED REPAIR COMPOUND**

- A. Mil. Spec. DOD-P-21035B, paint form.

**2.9 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS**

- A. Pipe Supports: Comply with MSS SP-58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-69.
- B. 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.
- C. 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.

- D. 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.
- E. 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.

## **2.10 PIPE PENETRATIONS**

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
1. For sleeves: Extend sleeve 25 mm (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.

#### **2.11 SPECIAL TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the Resident Engineer, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.
- D. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.
- E. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

#### **2.12 ASBESTOS**

- A. 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. 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.
- I. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum.
- J. 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.

**K. 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.

#### **3.4 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 COR 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.

### **3.5 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.

### **3.6 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.

### **3.7 MOTOR AND DRIVE ALIGNMENT**

- A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.
- B. Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

### **3.8 LUBRICATION**

- A. Lubricate all devices requiring lubrication prior to initial operation. Field-check all devices for proper lubrication.
- B. Equip all devices with required lubrication fittings or devices. Provide a minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to Resident Engineer in unopened containers that are properly identified as to application.
- C. Provide a separate grease gun with attachments for applicable fittings for each type of grease applied.
- D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

### **3.9 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.

### **3.10 STARTUP AND TEMPORARY OPERATION**

- A. 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.

**3.11 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.

**3.13 INSTRUCTIONS TO VA PERSONNEL**

- A. Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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**SECTION 23 05 12**  
**GENERAL MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation and connection of motors for HVAC equipment.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements common to more than one Section of Division 26.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- C. Section 23 34 00, HVAC FANS.
- D. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT.

**1.3 SUBMITTALS**

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Shop Drawings:
1. Provide documentation to demonstrate compliance with drawings and specifications.
  2. Include electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
- C. Manuals:
1. Submit simultaneously with the shop drawings, companion copies of complete installation, maintenance and operating manuals, including technical data sheets and application data.
- D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certification to the Resident Engineer:
1. Certification that the motors have been applied, installed, adjusted, lubricated, and tested according to manufacturer published recommendations.
- E. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

#### 1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Electrical Manufacturers Association (NEMA):
  - MG 1-2006 Rev. 1 2009 ..Motors and Generators
  - MG 2-2001 Rev. 1 2007...Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators
- C. National Fire Protection Association (NFPA):
  - 70-2008.....National Electrical Code (NEC)
- D. Institute of Electrical and Electronics Engineers (IEEE):
  - 112-04.....Standard Test Procedure for Polyphase Induction Motors and Generators
- E. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
  - 90.1-2007.....Energy Standard for Buildings Except Low-Rise Residential Buildings

## PART 2 - PRODUCTS

### 2.1 MOTORS

- A. For alternating current, fractional and integral horsepower motors, NEMA Publications MG 1 and MG 2 shall apply.
- B. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors as scheduled. Unless otherwise specified for a particular application, use electric motors with the following requirements.
- C. Single-phase Motors: Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.
- D. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.
  - 1. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

E. Voltage ratings shall be as follows:

1. Single phase:

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

2. Three phase:

- a. Motors connected to 208-volt systems: 200 volts.
- b. Motors, less than 74.6 kW (100 HP), connected to 240 volt or 480 volt systems: 208-230/460 volts, dual connection.
- c. Motors, 74.6 kW (100 HP) or 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 (Over 600V): Shall conform to NEMA Standards for connection to the nominal system voltage shown on the drawings.

F. Number of phases shall be as follows:

- 1. Motors, less than 373 W (1/2 HP): Single phase.
- 2. Motors, 373 W (1/2 HP) and larger: 3 phase.
- 3. Exceptions:
  - a. Hermetically sealed motors.
  - b. Motors for equipment assemblies, less than 746 W (one HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

G. Motors shall be designed for operating the connected loads continuously in a 40°C (104°F) environment, where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation. If the motors exceed 40°C (104°F), the motors shall be rated for the actual ambient temperatures.

H. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.

I. Motor Enclosures:

- 1. Shall be the NEMA types as specified and/or shown on the drawings.
- 2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the

environmental conditions where the motors are being installed.

Enclosure requirements for certain conditions are as follows:

- a. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.
  - b. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.
  - c. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.
3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

J. 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 time or cost to the Government.
2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
  - a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
  - b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
  - c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.
4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated "inverter-duty" per NEMA Standard, MG1, Part 31.4.4.2. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

K. Additional requirements for specific motors, as indicated in the other sections listed in Article 1.2, shall also apply.

L. Energy-Efficient Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 Watts (1 HP) or more shall meet the minimum full-load efficiencies as indicated in the following table. Motors of 746 Watts or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section. Motors not specified as "premium efficiency" shall comply with the Energy Policy Act of 2005 (EPACT).

Minimum Premium Efficiencies Open Drip-Proof				Minimum Premium Efficiencies Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

M. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

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

#### **3.2 FIELD TESTS**

- A. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before start-up. All shall test free from grounds.
- B. Perform Load test in accordance with ANSI/IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.
- C. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

#### **3.3 STARTUP AND TESTING**

- A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

#### **3.4 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.

#### **3.5 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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**SECTION 23 07 11**  
**HVAC INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Field-applied insulation for thermal efficiency and condensation control for:
  - 1. HVAC piping, ductwork and equipment.
  - 2. Re-insulation of HVAC piping, ductwork and equipment, plumbing piping and equipment and boiler plant piping, breeching and stacks and equipment after asbestos abatement.
- B. Definitions
  - 1. ASJ: All service jacket, white finish facing or jacket.
  - 2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
  - 3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
  - 4. Concealed: Ductwork and piping above ceilings and in chases, and pipe spaces.
  - 5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
  - 6. FSK: Foil-scrim-kraft facing.
  - 7. Hot: HVAC Ductwork handling air at design temperature above 16 degrees C (60 degrees F); HVAC equipment or piping handling media above 41 degrees C (105 degrees F).
  - 8. Density:  $\text{kg/m}^3$  - kilograms per cubic meter (Pcf - pounds per cubic foot).
  - 9. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
  - 10. Thermal conductance: Heat flow rate through materials.
    - a. Flat surface: Watt per square meter (BTU per hour per square foot).
    - b. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).

11. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.
13. HPS: High pressure steam (415 kPa [60 psig] and above).
14. HPR: High pressure steam condensate return.
15. MPS: Medium pressure steam (110 kPa [16 psig] thru 414 kPa [59 psig]).
16. MPR: Medium pressure steam condensate return.
17. LPS: Low pressure steam (103 kPa [15 psig] and below).
18. LPR: Low pressure steam condensate gravity return.
19. PC: Pumped condensate.
20. HWH: Hot water heating supply.
21. HWHR: Hot water heating return.
22. GH: Hot glycol-water heating supply.
23. GHR: Hot glycol-water heating return.
24. FWPD: Feedwater pump discharge.
25. FWPS: Feedwater pump suction.
26. CTPD: Condensate transfer pump discharge.
27. CTPS: Condensate transfer pump suction.
28. VR: Vacuum condensate return.
29. CPD: Condensate pump discharge.
30. R: Pump recirculation.
31. FOS: Fuel oil supply.
32. FOR: Fuel oil return.
33. CW: Cold water.
34. SW: Soft water.
35. HW: Hot water.
36. CH: Chilled water supply.
37. CHR: Chilled water return.
38. GC: Chilled glycol-water supply.
39. GCR: Chilled glycol-water return.



40. RS: Refrigerant suction.

41. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

## **1.2 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- C. Section 23 22 13, STEAM and CONDENSATE HEATING PIPING.
- D. Section 23 23 00, REFRIGERANT PIPING: Requirements for refrigerant piping and fittings.
- E. Section 23 31 00, HVAC DUCTS AND CASINGS: Ductwork, plenum and fittings.
- F. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS. Requirements for commissioning, systems readiness checklists, and training.

## **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.
  - 2. Test methods: ASTM E84, UL 723, or NFPA 255.
  - 3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
  - 4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.
- C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Shop Drawings:
  - 1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
    - a. Insulation materials: Specify each type used and state surface burning characteristics.
    - b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
    - c. Insulation accessory materials: Each type used.
    - d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
    - e. Make reference to applicable specification paragraph numbers for coordination.

#### **1.5 STORAGE AND HANDLING OF MATERIAL**

- A. Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Federal Specifications (Fed. Spec.):
  - L-P-535E (2)- 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):

A167-99(2004).....Standard Specification for Stainless and  
Heat-Resisting Chromium-Nickel Steel Plate,  
Sheet, and Strip

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

C449-07.....Standard Specification for Mineral Fiber  
Hydraulic-Setting Thermal Insulating and  
Finishing Cement

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

C547-07.....Standard Specification for Mineral Fiber pipe  
Insulation

C552-07.....Standard Specification for Cellular Glass  
Thermal Insulation

C553-08.....Standard Specification for Mineral Fiber  
Blanket Thermal Insulation for Commercial and  
Industrial Applications

C585-09.....Standard Practice for Inner and Outer Diameters  
of Rigid Thermal Insulation for Nominal Sizes  
of Pipe and Tubing (NPS System) R (1998)

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
- E119-09c.....Standard Test Method for Fire Tests of Building Construction and 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):
- 90A-09.....Standard for the Installation of Air Conditioning and Ventilating Systems
- 96-08.....Standards for Ventilation Control and Fire Protection of Commercial Cooking Operations
- 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/m<sup>3</sup> (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/m<sup>3</sup> (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 CELLULAR GLASS CLOSED-CELL**

- A. Comply with Standard ASTM C177, C518, density 120 kg/m<sup>3</sup> (7.5 pcf) nominal, k = 0.033 (0.29) at 24~~0~~ degrees C (75 degrees F).
- B. Pipe insulation for use at temperatures up to 200 degrees C (400 degrees F) with all service vapor retarder jacket.

## **2.3 INSULATION FACINGS AND JACKETS**

- A. Vapor Retarder, higher strength with low water permeance  $\leq$  0.02 or less perm rating, Beach puncture 50 units for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.
- B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.
- D. Factory composite materials may be used provided that they have been tested and certified by the manufacturer.

- E. 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.

#### **2.4 ADHESIVE, MASTIC, CEMENT**

- A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
- B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.
- C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
- D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.
- E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
- F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- G. Other: Insulation manufacturers' published recommendations.

#### **2.5 MECHANICAL FASTENERS**

- A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching galvanized steel.
- C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
- D. Bands: 13 mm (0.5 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

#### **2.6 REINFORCEMENT AND FINISHES**

- A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
- B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.
- C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.

- E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.
- F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

## **2.7 FIRESTOPPING MATERIAL**

- A. Other than pipe and duct insulation, refer to Section 07 84 00, FIRESTOPPING.

## **2.8 FLAME AND SMOKE**

- A. Unless shown otherwise, all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

# **PART 3 - EXECUTION**

## **3.1 GENERAL REQUIREMENTS**

- A. Required pressure tests of duct and piping joints and connections shall be completed and the work approved by the Resident Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories), and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor retarder over ends and exposed edges of insulation. Anchors, supports and other metal

projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

- D. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.
- E. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- F. Protect all 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.
- G. Insulate steam traps.
- H. HVAC work not to be insulated:
  - 1. Internally insulated ductwork and air handling units.
  - 2. Relief air ducts (Economizer cycle exhaust air).
  - 3. Exhaust air ducts and plenums, and ventilation exhaust air shafts.
- I. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.
- J. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.
- K. Firestop Pipe and Duct insulation:
  - 1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.
  - 2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
    - a. Pipe risers through floors
    - b. Pipe or duct chase walls and floors
    - c. Smoke partitions
    - d. Fire partitions



### 3.2 INSULATION INSTALLATION

#### A. Mineral Fiber Board:

1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
2. Plain board:
  - a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
  - b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.
  - c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.

#### B. Flexible Mineral Fiber Blanket:

1. Adhere insulation to metal with 75 mm (3 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
2. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units,

coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.

3. Concealed supply air ductwork.
  - a. Above ceilings at a roof level, in attics, and duct work exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with FSK.
  - b. Above ceilings for other than roof level: 40 mm (1 ½ inch) thick insulation faced with FSK.
4. Concealed return air duct:
  - a. Above ceilings at a roof level, unconditioned areas, and in chases with external wall or containing steam piping; 40 mm (1-1/2 inch) thick, insulation faced with FSK.
  - b. Concealed return air ductwork in other locations need not be insulated.
5. Concealed outside air duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.

C. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
  - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
  - b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.

- c. Factory-molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
- d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
- 3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.
- D. 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.
- E. Flexible Elastomeric Cellular Thermal Insulation:
  - 1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
  - 2. Pipe and tubing insulation:
    - a. Use proper size material. Do not stretch or strain insulation.
    - b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
    - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
  - 3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
  - 4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section).

5. Minimum 20 mm (0.75 inch) thick insulation for pneumatic control lines for a minimum distance of 6 m (20 feet) from discharge side of the refrigerated dryer.

### 3.3 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

### 3.4 PIPE INSULATION SCHEDULE

Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	Insulation Material	Less than 25 (1)	25 - 32 (1 - 1½)	38 - 75 (1½ - 3)	100 (4) and Above
100-121 degrees C (212-250 degrees F) (LPS)	Mineral Fiber (Above ground piping only)	62 (2.5)	62 (2.5)	75 (3.0)	75 (3.0)
38-94 degrees C (100-200 degrees F) (LPR)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
4-16 degrees C (40-60 degrees F) (CH, CHR, RS for DX refrigeration)	Cellular Glass Closed-Cell	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)

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**SECTION 23 08 00**  
**COMMISSIONING OF HVAC SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 23.
- B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00, GENERAL COMMISSIONING 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.

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**SECTION 23 22 13**  
**STEAM AND CONDENSATE HEATING PIPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Steam, condensate and vent piping inside buildings.

**1.2 RELATED WORK**

- A. General mechanical requirements and items, which are common to more than one section of Division 23: Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Piping insulation: Section 23 07 11, HVAC INSULATION.

**1.3 QUALITY ASSURANCE**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC, 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. All specified steam system components.
- C. Coordination Drawings: Refer to Article, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. 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  
A126-2004.....Standard Specification for Gray Iron Castings  
for Valves, Flanges, and Pipe Fittings  
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
- A536-84(2004)e1 ..... Standard Specification for Ductile Iron Castings
- 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.):
- MIL-S-901D-1989.....Shock Tests, H.I. (High Impact) Shipboard Machinery, Equipment, and Systems

- H. National Board of Boiler and Pressure Vessel Inspectors (NB): Relieving Capacities of Safety Valves and Relief Valves
- I. Tubular Exchanger Manufacturers Association: TEMA 18th Edition, 2000

## **PART 2 - PRODUCTS**

### **2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES**

- A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

### **2.2 PIPE AND TUBING**

- A. Steam Piping: Steel, ASTM A53, 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.
  - 4. Unions: ASME B16.39.
  - 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.
- B. Bronze Flanges and Flanged Fittings: ASME B16.24.
- C. Fittings: ANSI/ASME B16.18 cast copper or ANSI/ASME B16.22 solder wrought copper.

#### **2.5 DIELECTRIC FITTINGS**

- A. Provide where copper tubing and ferrous metal pipe are joined.
- B. 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.
- C. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.
- 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

- A. Pipe Thread: ANSI B1.20.
- 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.

G. Manual Radiator/Convactor Valves: Brass, packless, with position indicator.

**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 STEAM SYSTEM COMPONENTS**

- A. 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. 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.
  5. Floats: Stainless steel.



6. Inverted bucket traps: Provide bi-metallic thermostatic element for rapid release of non-condensables.

### **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. 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. Where copper piping is connected to steel piping, provide dielectric connections.

### **3.2 PIPE JOINTS**

- A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder's qualification requirements under "Quality Assurance" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Screwed: Threads shall conform to ASME B1.20; 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.

### **3.4 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 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.

### **3.6 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.

### **3.7 OPERATING AND PERFORMANCE TEST AND INSTRUCTION**

- A. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Adjust red set hand on pressure gages to normal working pressure.

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**SECTION 23 23 00**  
**REFRIGERANT PIPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Field refrigerant piping for direct expansion HVAC systems.
- B. Refrigerant piping shall be sized, selected, and designed either by the equipment manufacturer or in strict accordance with the manufacturer's published instructions. The schematic piping diagram shall show all accessories such as, stop valves, level indicators, liquid receivers, oil separator, gauges, thermostatic expansion valves, solenoid valves, moisture separators and driers to make a complete installation.
- C. Definitions:
  - 1. Refrigerating system: Combination of interconnected refrigerant-containing parts constituting one closed refrigeration circuit in which a refrigerant is circulated for the purpose of extracting heat.
    - a. Low side means the parts of a refrigerating system subjected to evaporator pressure.
    - b. High side means the parts of a refrigerating system subjected to condenser pressure.
  - 2. Brazed joint: A gas-tight joint obtained by the joining of metal parts with alloys which melt at temperatures higher than 449 degrees C (840 degrees F) but less than the melting temperatures of the joined parts.

**1.2 RELATED WORK**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- B. Section 23 07 11, HVAC INSULATION: Requirements for piping insulation.

### **1.3 QUALITY ASSURANCE**

- A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Comply with ASHRAE Standard 15, Safety Code for Mechanical Refrigeration. The application of this Code is intended to assure the safe design, construction, installation, operation, and inspection of every refrigerating system employing a fluid which normally is vaporized and liquefied in its refrigerating cycle.
- C. Comply with ASME B31.5: Refrigerant Piping and Heat Transfer Components.
- D. Products shall comply with UL 207 "Refrigerant-Containing Components and Accessories, "Nonelectrical"; or UL 429 "Electrical Operated Valves."

### **1.4 SUBMITTALS**

- A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Shop Drawings:
  - 1. Complete information for components noted, including valves and refrigerant piping accessories, clearly presented, shall be included to determine compliance with drawings and specifications for components noted below:
    - a. Tubing and fittings
    - b. Valves
    - c. Strainers
    - d. Moisture-liquid indicators
    - e. Filter-driers
    - f. Flexible metal hose
    - g. Liquid-suction interchanges
    - h. Oil separators (when specified)
    - i. Gages
    - j. Pipe and equipment supports
    - k. Refrigerant and oil
    - l. Pipe/conduit roof penetration cover
    - m. Soldering and brazing materials
  - 2. Layout of refrigerant piping and accessories, including flow capacities, valves locations, and oil traps slopes of horizontal runs, floor/wall penetrations, and equipment connection details.

- C. Certification: Copies of certificates for welding procedure, performance qualification record and list of welders' names and symbols.
- D. Design Manual: Furnish two copies of design manual of refrigerant valves and accessories.

#### 1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning, Heating, and Refrigeration Institute (ARI/AHRI):
  - 495-1999 (R2002).....Standard for Refrigerant Liquid Receivers
  - 730-2005.....Flow Capacity Rating of Suction-Line Filters and Suction-Line Filter-Driers
  - 750-2007.....Thermostatic Refrigerant Expansion Valves
  - 760-2007.....Performance Rating of Solenoid Valves for Use with Volatile Refrigerants
- C. American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE):
  - ANSI/ASHRAE 15-2007.....Safety Standard for Refrigeration Systems (ANSI)
  - ANSI/ASHRAE 17-2008.....Method of Testing Capacity of Thermostatic Refrigerant Expansion Valves (ANSI)
  - 63.1-95 (RA 01).....Method of Testing Liquid Line Refrigerant Driers (ANSI)
- D. American National Standards Institute (ANSI):
  - ASME (ANSI)A13.1-2007...Scheme for Identification of Piping Systems
  - Z535.1-2006.....Safety Color Code
- E. American Society of Mechanical Engineers (ASME):
  - ANSI/ASME B16.22-2001 (R2005)  
Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings (ANSI)
  - ANSI/ASME B16.24-2006 Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500 (ANSI)
  - ANSI/ASME B31.5-2006....Refrigeration Piping and Heat Transfer Components (ANSI)
  - ANSI/ASME B40.100-2005..Pressure Gauges and Gauge Attachments
  - ANSI/ASME B40.200-2008..Thermometers, Direct Reading and Remote Reading

F. American Society for Testing and Materials (ASTM)

A126-04.....Standard Specification for Gray Iron Castings  
for Valves, Flanges, and Pipe FittingsB32-08

Standard Specification for Solder Metal

B88-03.....Standard Specification for Seamless Copper  
Water Tube

B88M-05.....Standard Specification for Seamless Copper  
Water Tube (Metric)

B280-08.....Standard Specification for Seamless Copper Tube  
for Air Conditioning and Refrigeration Field  
Service

G. American Welding Society, Inc. (AWS):

Brazing Handbook

A5.8/A5.8M-04.....Standard Specification for Filler Metals for  
Brazing and Braze Welding

H. Federal Specifications (Fed. Spec.)

Fed. Spec. GG

I. Underwriters Laboratories (U.L.):

U.L.207-2009.....Standard for Refrigerant-Containing Components  
and Accessories, Nonelectrical

U.L.429-99 (Rev.2006)...Standard for Electrically Operated Valves

**PART 2 - PRODUCTS**

**2.1 PIPING AND FITTINGS**

A. Refrigerant Piping: For piping up to 100 mm (4 inch) use Copper  
refrigerant tube, ASTM B280, cleaned, dehydrated and sealed, marked ACR  
on hard temper straight lengths. Coils shall be tagged ASTM B280 by the  
manufacturer. For piping over 100 mm (4 inch) use A53 Black SML steel.

B. Fittings, Valves and Accessories:

1. Copper fittings: Wrought copper fittings, ASME B16.22.

a. Brazed Joints, refrigerant tubing: Cadmium free, AWS A5.8/A5.8M,  
45 percent silver brazing alloy, Class BAg-5.

b. Solder Joints, water and drain: 95-5 tin-antimony, ASTM B32  
(95TA).

2. Steel fittings: ASTM wrought steel fittings.

a. Refrigerant piping - Welded Joints.

3. Flanges and flanged fittings: ASME B16.24.

4. Refrigeration Valves:

- a. Stop Valves: Brass or bronze alloy, packless, or packed type with gas tight cap, frost proof, back seating.
  - b. Pressure Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; UL listed. Forged brass with nonferrous, corrosion resistant internal working parts of high strength, cast iron bodies conforming to ASTM A126, Grade B. Set valves in accordance with ASHRAE Standard 15.
  - c. Solenoid Valves: Comply with ARI 760 and UL 429, UL-listed, two-position, direct acting or pilot-operated, moisture and vapor-proof type of corrosion resisting materials, designed for intended service, and solder-end connections. Fitted with suitable NEMA 250 enclosure of type required by location and normally open holding coil.
  - d. Thermostatic Expansion Valves: Comply with ARI 750. Brass body with stainless-steel or non-corrosive nonferrous internal parts, diaphragm and spring-loaded (direct-operated) type with sensing bulb and distributor having side connection for hot-gas bypass and external equalizer. Size and operating characteristics as recommended by manufacturer of evaporator and factory set for superheat requirements. Solder-end connections. Testing and rating in accordance with ASHRAE Standard 17.
  - e. Check Valves: Brass or bronze alloy with swing or lift type, with tight closing resilient seals for silent operation; designed for low pressure drop, and with solder-end connections. Direction of flow shall be legibly and permanently indicated on the valve body.
5. Strainers: Designed to permit removing screen without removing strainer from piping system, and provided with screens 80 to 100 mesh in liquid lines DN 25 (NPS 1) and smaller, 60 mesh in liquid lines larger than DN 25 (NPS 1), and 40 mesh in suction lines. Provide strainers in liquid line serving each thermostatic expansion valve, and in suction line serving each refrigerant compressor not equipped with integral strainer.

6. Refrigerant Moisture/Liquid Indicators: Double-ported type having heavy sight glasses sealed into forged bronze body and incorporating means of indicating refrigerant charge and moisture indication. Provide screwed brass seal caps.
7. Refrigerant Filter-Dryers: UL listed, angle or in-line type, as shown on drawings. Conform to ARI Standard 730 and ASHRAE Standard 63.1. Heavy gage steel shell protected with corrosion-resistant paint; perforated baffle plates to prevent desiccant bypass. Size as recommended by manufacturer for service and capacity of system with connection not less than the line size in which installed. Filter driers with replaceable filters shall be furnished with one spare element of each type and size.
8. Flexible Metal Hose: Seamless bronze corrugated hose, covered with bronze wire braid, with standard copper tube ends. Provide in suction and discharge piping of each compressor.

## 2.2 GAGES

- A. Temperature Gages: Comply with ASME B40.200. Industrial-duty type and in required temperature range for service in which installed. Gages shall have Celsius scale in 1-degree (Fahrenheit scale in 2-degree) graduations and with black number on a white face. The pointer shall be adjustable. Rigid stem type temperature gages shall be provided in thermal wells located within 1525 mm (5 feet) of the finished floor. Universal adjustable angle type or remote element type temperature gages shall be provided in thermal wells located 1525 to 2135 mm (5 to 7 feet) above the finished floor. Remote element type temperature gages shall be provided in thermal wells located 2135 mm (7 feet) above the finished floor.
- B. Vacuum and Pressure Gages: Comply with ASME B40.100 and provide with throttling type needle valve or a pulsation dampener and shut-off valve. Gage shall be a minimum of 90 mm (3-1/2 inches) in diameter with a range from 0 kPa (0 psig) to approximately 1.5 times the maximum system working pressure. Each gage range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.
  1. Suction: 101 kPa (30 inches Hg) vacuum to 1723 kPa (gage) (250 psig).
  2. Discharge: 0 to 3445 kPa (gage) (0 to 500 psig).



### **2.3 PIPE SUPPORTS**

- A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

### **2.4 REFRIGERANTS AND OIL**

- A. Provide EPA approved refrigerant and oil for proper system operation.

### **2.5 PIPE INSULATION FOR DX HVAC SYSTEMS**

- A. Refer to specification Section 23 07 11, HVAC INSULATION.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install refrigerant piping and refrigerant containing parts in accordance with ASHRAE Standard 15 and ASME B31.5
1. Install piping as short as possible, with a minimum number of joints, elbow and fittings.
  2. Install piping with adequate clearance between pipe and adjacent walls and hangers to allow for service and inspection. Space piping, including insulation, to provide 25 mm (1 inch) minimum clearance between adjacent piping or other surface. Use pipe sleeves through walls, floors, and ceilings, sized to permit installation of pipes with full thickness insulation.
  3. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing.
  4. Use copper tubing in protective conduit when installed below ground.
  5. Install hangers and supports per ASME B31.5 and the refrigerant piping manufacturer's recommendations.
- B. Joint Construction:
1. Brazed Joints: Comply with AWS "Brazing Handbook" and with filler materials complying with AWS A5.8/A5.8M.
    - a. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper tubing.
    - b. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
    - c. Swab fittings and valves with manufacturer's recommended cleaning fluid to remove oil and other compounds prior to installation.

- d. Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.
- C. Protect refrigerant system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.
- D. Pipe relief valve discharge to outdoors for systems containing more than 45 kg (100 lbs) of refrigerant.
- E. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, HVAC INSULATION.

### **3.2 PIPE AND TUBING INSULATION**

- A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Apply two coats of weather-resistant finish as recommended by the manufacturer to insulation exposed to outdoor weather.

### **3.3 SIGNS AND IDENTIFICATION**

- A. Each refrigerating system erected on the premises shall be provided with an easily legible permanent sign securely attached and easily accessible, indicating thereon the name and address of the installer, the kind and total number of pounds of refrigerant required in the system for normal operations, and the field test pressure applied.
- B. Systems containing more than 50 kg (110 lb) of refrigerant shall be provided with durable signs, in accordance with ANSI A13.1 and ANSI Z535.1, having letters not less than 13 mm (1/2 inch) in height designating:
  - 1. Valves and switches for controlling refrigerant flow, the ventilation and the refrigerant compressor(s).
  - 2. Signs on all exposed high pressure and low pressure piping installed outside the machinery room, with name of the refrigerant and the letters "HP" or "LP."

### **3.4 FIELD QUALITY CONTROL**

- A. Prior to initial operation examine and inspect piping system for conformance to plans and specifications and ASME B31.5. Correct equipment, material, or work rejected because of defects or nonconformance with plans and specifications, and ANSI codes for pressure piping.
- B. After completion of piping installation and prior to initial operation, conduct test on piping system according to ASME B31.5. Furnish materials and equipment required for tests. Perform tests in the presence of Resident Engineer. If the test fails, correct defects and perform the test again until it is satisfactorily done and all joints are proved tight.
  - 1. Every refrigerant-containing parts of the system that is erected on the premises, except compressors, condensers, evaporators, safety devices, pressure gages, control mechanisms and systems that are factory tested, shall be tested and proved tight after complete installation, and before operation.
  - 2. The high and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the pressure-relief device protecting the high or low side of the system, respectively, except systems erected on the premises using non-toxic and non-flammable Group A1 refrigerants with copper tubing not exceeding DN 18 (NPS 5/8). This may be tested by means of the refrigerant charged into the system at the saturated vapor pressure of the refrigerant at 20 degrees C (68 degrees F) minimum.
- C. Test Medium: A suitable dry gas such as nitrogen or shall be used for pressure testing. The means used to build up test pressure shall have either a pressure-limiting device or pressure-reducing device with a pressure-relief device and a gage on the outlet side. The pressure relief device shall be set above the test pressure but low enough to prevent permanent deformation of the system components.

### 3.5 SYSTEM TEST AND CHARGING

- A. System Test and Charging: As recommended by the equipment manufacturer or as follows:
1. Connect a drum of refrigerant to charging connection and introduce enough refrigerant into system to raise the pressure to 70 kPa (10 psi) gage. Close valves and disconnect refrigerant drum. Test system for leaks with halide test torch or other approved method suitable for the test gas used. Repair all leaking joints and retest.
  2. Connect a drum of dry nitrogen to charging valve and bring test pressure to design pressure for low side and for high side. Test entire system again for leaks.
  3. Evacuate the entire refrigerant system by the triplicate evacuation method with a vacuum pump equipped with an electronic gage reading in mPa (microns). Pull the system down to 665 mPa (500 microns) 665 mPa (2245.6 inches of mercury at 60 degrees F) and hold for four hours then break the vacuum with dry nitrogen (or refrigerant). Repeat the evacuation two more times breaking the third vacuum with the refrigeration to be charged and charge with the proper volume of refrigerant.

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**SECTION 23 31 00**  
**HVAC DUCTS AND CASINGS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Ductwork and accessories for HVAC including the following:
  - 1. Supply air, return air, outside air, exhaust, make-up air, and relief systems.
- B. Definitions:
  - 1. SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible.
  - 2. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
  - 3. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
  - 4. Exposed Duct: Exposed to view in a finished room.

**1.2 RELATED WORK**

- A. General Mechanical Requirements: Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Duct Insulation: Section 23 07 11, HVAC INSULATION.
- C. Return Air and Exhaust Air Fans: Section 23 34 00, HVAC FANS.

**1.3 QUALITY ASSURANCE**

- A. Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Fire Safety Code: Comply with NFPA 90A.
- C. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.
- D. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown on the drawings.
- E. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Rectangular ducts:
    - a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.
    - b. Duct liner.
    - c. Sealants and gaskets.
    - d. Access doors.
  - 2. Flexible connections.
- C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 11.

#### 1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Civil Engineers (ASCE):
  - ASCE7-05.....Minimum Design Loads for Buildings and Other Structures
- C. American Society for Testing and Materials (ASTM):
  - A167-99(2009).....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - A653-09.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process
  - A1011-09a.....Standard Specification for Steel, Sheet and Strip, Hot rolled, Carbon, structural, High-Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, and Ultra-High Strength
  - B209-07.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  - C1071-05e1.....Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
  - E84-09a.....Standard Test Method for Surface Burning Characteristics of Building Materials

- D. National Fire Protection Association (NFPA):
- 90A-09.....Standard for the Installation of Air  
Conditioning and Ventilating Systems
  - 96-08.....Standard for Ventilation Control and Fire  
Protection of Commercial Cooking Operations
- E. Sheet Metal and Air Conditioning Contractors National Association  
(SMACNA):
- 2nd Edition - 2005.....HVAC Duct Construction Standards, Metal and  
Flexible
  - 1st Edition - 1985.....HVAC Air Duct Leakage Test Manual
  - 6th Edition - 2003.....Fibrous Glass Duct Construction Standards
- F. Underwriters Laboratories, Inc. (UL):
- 181-08.....Factory-Made Air Ducts and Air Connectors
  - 555-06 .....Standard for Fire Dampers
  - 555S-06 .....Standard for Smoke Dampers

## **PART 2 - PRODUCTS**

### **2.1 DUCT MATERIALS AND SEALANTS**

- A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A653, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.
- B. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, paragraph S1.9.
- 1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.
  - 2. Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.
  - 3. Gaskets in Flanged Joints: Soft neoprene.
- C. Approved factory-made joints may be used.

## **2.2 DUCT CONSTRUCTION AND INSTALLATION**

- A. Regardless of the pressure classifications outlined in the SMACNA Standards, fabricate and seal the ductwork in accordance with the following pressure classifications:
- B. Duct Pressure Classification:
  - 0 to 50 mm (2 inch)
  - > 50 mm to 75 mm (2 inch to 3 inch)
  - > 75 mm to 100 mm (3 inch to 4 inch)Show pressure classifications on the floor plans.
- C. Seal Class: All ductwork shall receive Class A Seal
- D. Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards Section 6, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 500 mm (20 inches) wide by 1200 - 1350 mm (48 - 54 inches) high. Provide view port in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.
- E. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards. Refer to SMACNA Detail Figure 2-12 for Single Blade and Figure 2.13 for Multi-blade Volume Dampers.
- F. Duct Hangers and Supports: Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round duct.

## **2.3 DUCT LINER (WHERE INDICATED ON DRAWINGS)**

- A. Duct sizes shown on drawings for lined duct are clear opening inside lining.
- B. Duct liner is only permitted to be used for return, relief and general exhaust ducts. Duct liner is not permitted for outside air ducts, supply air ducts or any other positive pressure ductwork (provide exterior insulation only).
- C. Rectangular Duct or Casing Liner: ASTM C1071, Type I (flexible), or Type II (board), 25 mm (one inch) minimum thickness, applied with mechanical fasteners and 100 percent coverage of adhesive in conformance with SMACNA, Duct Liner Application Standard.



## **2.4 DUCT ACCESS DOORS, PANELS AND SECTIONS**

- A. Provide access doors, sized and located for maintenance work, upstream, in the following locations:
  - 1. Each duct mounted coil and humidifier.
  - 2. Each fire damper (for link service), smoke damper and automatic control damper.
  - 3. Each duct mounted smoke detector.
  - 4. For cleaning operating room supply air duct and kitchen hood exhaust duct, locate access doors at 6 m (20 feet) intervals and at each change in duct direction.
- B. Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inch by 12 inch) minimum where possible. Access sections in insulated ducts shall be double-wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.
  - 1. For rectangular ducts: Refer to SMACNA HVAC Duct Construction Standards (Figure 2-12).
  - 2. For round and flat oval duct: Refer to SMACNA HVAC duct Construction Standards (Figure 2-11).

## **2.5 FLEXIBLE DUCT CONNECTIONS**

- A. Where duct connections are made to fans, air terminal units, and air handling units, install a non-combustible flexible connection of 822 g (29 ounce) neoprene coated fiberglass fabric approximately 150 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to insure that no vibration is transmitted.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.

- B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:
1. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
  2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
  3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards.
  4. Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Chapter 6. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.
- C. Install duct hangers and supports in accordance with SMACNA Standards, Chapter 4.
- D. Low Pressure Duct Liner: Install in accordance with SMACNA, Duct Liner Application Standard.
- E. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by Resident Engineer. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

### **3.2 OPERATING AND PERFORMANCE TESTS**

- A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

- - - E N D - - -

**SECTION 23 34 00**  
**HVAC FANS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Fans for heating, ventilating and air conditioning.
- B. Product Definitions: AMCA Publication 99, Standard 1-66.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- D. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.

**1.3 QUALITY ASSURANCE**

- A. Refer to paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Fans and power ventilators shall be listed in the current edition of AMCA 261, and shall bear the AMCA performance seal.
- C. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).
- D. Fans and power ventilators shall comply with the following standards:
  - 1. Testing and Rating: AMCA 210.
  - 2. Sound Rating: AMCA 300.
- E. Performance Criteria:
  - 1. The fan schedule shall show the design air volume and static pressure. Select the fan motor HP by increasing the fan BHP by 10 percent to account for the drive losses and field conditions.
  - 2. Select the fan operating point as follows:
    - a. Forward Curve and Axial Flow Fans: Right hand side of peak pressure point
    - b. Air Foil, Backward Inclined, or Tubular: At or near the peak static efficiency
- F. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge where exposed to operating and maintenance personnel.

G. Corrosion Protection:

1. Except for fans in fume hood exhaust service, all steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturers paint and paint system shall meet the minimum specifications of: ASTM D1735 water fog; ASTM B117 salt spray; ASTM D3359 adhesion; and ASTM G152 and G153 for carbon arc light apparatus for exposure of non-metallic material.
2. Fans for general purpose fume hoods, or chemical hoods, and radioisotope hoods shall be constructed of materials compatible with the chemicals being transported in the air through the fan.

H. Spark-resistant construction: If flammable gas, vapor or combustible dust is present in concentrations above 20% of the Lower Explosive Limit (LEL), the fan construction shall be as recommended by AMCA's Classification for Spark-Resistant Construction. Drive set shall be comprised of non-static belts for use in an explosive.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Manufacturers Literature and Data:
  1. Propeller fans.
- C. Certified Sound power levels for each fan.
- D. Motor ratings types, electrical characteristics and accessories.
- E. Maintenance and Operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
- F. Certified fan performance curves for each fan showing cubic feet per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation.

**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 Movement and Control Association International, Inc. (AMCA):
  - 99-86.....Standards Handbook
  - 210-06.....Laboratory Methods of Testing Fans for  
Aerodynamic Performance Rating

- 261-09.....Directory of Products Licensed to bear the AMCA  
Certified Ratings Seal - Published Annually
- 300-08.....Reverberant Room Method for Sound Testing of  
Fans
- C. American Society for Testing and Materials (ASTM):
- B117-07a.....Standard Practice for Operating Salt Spray  
(Fog) Apparatus
- D1735-08.....Standard Practice for Testing Water Resistance  
of Coatings Using Water Fog Apparatus
- D3359-08.....Standard Test Methods for Measuring Adhesion by  
Tape Test
- G152-06.....Standard Practice for Operating Open Flame  
Carbon Arc Light Apparatus for Exposure of Non-  
Metallic Materials
- G153-04.....Standard Practice for Operating Enclosed Carbon  
Arc Light Apparatus for Exposure of Non-  
Metallic Materials
- D. National Fire Protection Association (NFPA):
- NFPA 96-08.....Standard for Ventilation Control and Fire  
Protection of Commercial Cooking Operations
- E. National Sanitation Foundation (NSF):
- 37-07.....Air Curtains for Entrance Ways in Food and Food  
Service Establishments
- F. Underwriters Laboratories, Inc. (UL):
- 181-2005.....Factory Made Air Ducts and Air Connectors

## **PART 2 - PRODUCTS**

### **2.1 PROPELLER FANS**

- A. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE.
- B. Belt-driven or direct-driven fans as indicated on drawings.
- C. Square steel panel, deep drawn venturi, arc welded to support arms and fan/motor support brackets, baked enamel finish. Provide wall collar for thru-wall installations.
- D. Motor, Motor Base and Drive: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Motor shall be totally enclosed type.
- E. Wire Safety Guards: Provide on exposed inlet and outlet.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install fan, motor and drive in accordance with manufacturer's instructions.
- B. Align fan and motor sheaves to allow belts to run true and straight.
- C. Bolt equipment to curbs with galvanized lag bolts.

**3.2 PRE-OPERATION MAINTENANCE**

- A. Lubricate bearings, pulleys, belts and other moving parts with manufacturer recommended lubricants.
- B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.
- C. Clean fan interiors to remove foreign material and construction dirt and dust.

**3.3 START-UP AND INSTRUCTIONS**

- A. Verify operation of motor, drive system and fan wheel according to the drawings and specifications.
- B. Check vibration and correct as necessary for air balance work.

- - - E N D - - -

**SECTION 23 81 00**  
**DECENTRALIZED UNITARY HVAC EQUIPMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies split-systems.
- B. Definitions:
  - 1. Energy Efficiency Ratio (EER): The ratio of net cooling capacity is Btu/h to total rate of electricity input in watts under designated operating conditions (Btu hour/Watt).
  - 2. Seasonal Energy Efficiency Ratio (EER): The ratio of the total cooling output of an air conditioner during its normal annual usage period for cooling in Btu/h divided by total electric energy input in watts during the same period (Btu hour/Watt).
  - 3. Unitary: A Unitary Air Conditioner consists of one or more factory-made assemblies which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function as well.
  - 4. Where such equipment is provided in more than one assembly the separated assemblies are to be designed to be used together and the requirements of rating are based upon use of matched assemblies.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS: Requirements for pre-test of equipment: Seismic requirements for non-structural equipment.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- C. Section 23 07 11, HVAC INSULATION: Requirements for piping insulation.
- D. Section 23 23 00, REFRIGERANT PIPING: Requirements for refrigerant pipes and fittings.
- E. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training.

**1.3 QUALITY ASSURANCE**

- A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Safety Standards: ASHRAE Standard 15, Safety Code for Mechanical Refrigeration.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Manufacturer's literature and data:
  - 1. Sufficient information, including capacities, pressure drops and piping connections clearly presented, shall be included to determine compliance with drawings and specifications for units noted below:
    - a. Unitary air conditioners:
      - 1) Split systems
  - 2. Unit Dimensions required clearances, operating weights accessories and start-up instructions.
  - 3. Electrical requirements, wiring diagrams, interlocking and control wiring showing factory installed and portions to be field installed.
  - 4. Mounting and flashing of the roof curb to the roofing structure with coordinating requirements for the roof membrane system.
- C. Certification: Submit proof of specified ARI Certification.
- D. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required sensible-to-heat-ratio, energy efficiency ratio (EER), and coefficient of performance (COP).
- E. Operating and Maintenance Manual: Submit three copies of Operating and Maintenance manual to Resident Engineer three weeks prior to final inspection.
- F. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
  - A-A-50502-90..... Air conditioner (Unitary Heat Pump) Air to Air (3000-300,000 Btu)
- C. Military Specifications (Mil. Specs.):
  - MIL-PRF-26915D-06.....Primer Coating, for Steel Surfaces



- D. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):
- 210/240-08.....Performance Rating of Unitary Air-Conditioning  
and Air-Source Heat Pump Equipment
  - 270-08.....Sound Rating of Outdoor Unitary Equipment
  - 310/380-04.....Standard for Packaged Terminal Air-Conditioners  
and Heat Pumps (CSA-C744-04)
  - 340/360-07.....Performance Rating of Commercial and Industrial  
Unitary Air-Conditioning and Heat Pump  
Equipment
  - 520-04.....Performance Rating of Positive Displacement  
Condensing Units
- E. Air Movement and Control Association (AMCA):
- 210-07.....Laboratory Methods of Testing Fans for  
Aerodynamic Performance Rating (ANSI)
  - 410-96.....Recommended Safety Practices for Users and  
Installers of Industrial and Commercial Fans
- F. American National Standards Institute (ANSI):
- S12.51-02(R2007).....Acoustics - Determination of Sound Power Levels  
of Noise Sources Using Sound Pressure -  
Precision Method for Reverberation Rooms (same  
as ISO 3741:1999)
- G. American Society of Heating, Refrigerating, and Air-Conditioning  
Engineers (ASHRAE):
- 2008 Handbook.....HVAC Systems and Equipment
  - 15-10.....Safety Standard for Refrigeration Systems  
(ANSI)
- H. American Society of Testing and Materials (ASTM):
- B117-09.....Standard Practice for Operating Salt Spray  
(Fog) Apparatus
- I. American Society of Civil Engineers (ASCE)
- ASCE 7-10.....Minimum Design Loads for Buildings and Other  
Structures
- J. National Electrical Manufacturer's Association (NEMA):
- MG 1-09 (R2010).....Motors and Generators (ANSI)
  - ICS 1-00 (R2005, R2008).Industrial Controls and Systems: General  
Requirements

- K. National Fire Protection Association (NFPA) Publications:  
90A-09.....Standard for the Installation of Air-  
Conditioning and Ventilating Systems

## **PART 2 - PRODUCTS**

### **2.1 SPLIT-SYSTEM AIR CONDITIONERS**

- A. Description: Factory assembled and tested, wall-mounted unit, with an air-cooled remote condensing unit, and field-installed refrigeration piping.
- B. Wall-Mounting, Evaporator-Fan Components:
1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
  2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.
  3. Drain Pan and Drain Connection: Comply with ASHRAE 62.1-2007.
  4. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with AHRI 210/240, and with thermal-expansion valve.
  5. Electric-Resistance Heating Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.
  6. Fan: Direct drive, centrifugal fan.
  7. Fan Motors: Comply with requirements in Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT for multi-tapped, multi-speed motors with internal thermal protection and permanent lubrication.
  8. Filters: Disposable, with MERV rating of 7 or higher according to ASHRAE 52.2.
- C. Air-Cooled, Compressor-Condenser Components:
1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Service valves, fittings, and gage ports shall be brass and located outside of the casing.

2. Compressor: Hermetically sealed inverter type mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
3. Compressor motor with manual-reset, high-pressure switch and automatic-reset, low-pressure switch.
4. Refrigerant: R-410A unless otherwise indicated.
5. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with AHRI 210/240, and with liquid subcooler.
6. Fan: Aluminum, propeller type, directly connected to motor.
7. Motor: Permanently lubricated, with integral thermal-overload protection.
8. Low Ambient Kit: Permit operation down to minus 18 deg C (0 deg F).
9. Mounting Base: Polyethylene.
10. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1-2004, "Energy Standard for Buildings except Low-Rise Residential Buildings."

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install units level and plumb maintaining manufacturer's recommended clearances and tolerances.
- B. Install roof-mounting compressor-condenser components on equipment supports. Anchor units to supports with removable, cadmium-plated fasteners.
- C. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.
- D. Install wall sleeves in finished wall assembly and weatherproof. Install and anchor wall sleeves to withstand, without damage seismic forces as required by code.

### **3.2 CONNECTIONS**

- A. Verify condensate drainage requirements.
- B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- C. Install piping adjacent to units to allow service and maintenance.
- D. Ground equipment and install power wiring, switches, and controls for self-contained and split systems.

- E. Connect refrigerant piping to coils with shutoff valves on the suction and liquid lines at the coil and a union or flange at each connection at the coil and condenser.

### **3.3 FIELD QUALITY CONTROL**

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections: After installing units and after electrical circuitry has been energized, test units for compliance with requirements. Inspect for and remove shipping bolts, blocks, and tie-down straps. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Remove and replace malfunctioning units and retest as specified above.

### **3.4 INSTRUCTIONS**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.

### **3.5 STARTUP AND TESTING**

- A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days' prior notice.

### **3.6 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.

### **3.7 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

- - - END - - -

**SECTION 23 82 00**  
**CONVECTION HEATING AND COOLING UNITS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Fan-coil unit, radiant ceiling panels, and unit heater.

**1.2 RELATED WORK**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- B. Section 23 31 00, HVAC DUCTS and CASINGS: Ducts and flexible connectors.
- C. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training.
- D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

**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. Fan-Coil units.
  - 2. Unit heaters.
  - 3. Radiant ceiling panels.
- C. Certificates:
  - 1. Compliance with paragraph, QUALITY ASSURANCE.
  - 2. Compliance with specified standards.
- D. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.
- E. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

## **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute / Air Conditioning, Heating and Refrigeration Institute (ANSI/AHRI):
  - 440-08.....Performance Rating of Room Fan Coils
  - National Fire Protection Association (NFPA):
    - 90A-09.....Standard for the Installation of Air Conditioning and Ventilating Systems
    - 70-11.....National Electrical Code
- C. Underwriters Laboratories, Inc. (UL):
  - 181-08.....Standard for Factory-Made Air Ducts and Air Connectors
  - 1995-05.....Heating and Cooling Equipment

## **1.6 GUARANTY**

- A. In accordance with FAR clause 52.246-21

## **PART 2 - PRODUCTS**

### **2.1 ROOM FAN-COIL UNITS**

- A. Capacity Certification: AHRI 440.
- B. Safety Compliance: NEC compliant and UL listed.
- C. Chassis: Galvanized steel, acoustically and thermally insulated to attenuate noise and prevent condensation.
- D. Cabinet: Minimum 1.3 mm (18 gage) steel reinforced and braced. Arrange components and provide adequate space for installation of piping package and control valves. Finish shall be factory-baked enamel in color as selected by the architect on all exposed surfaces.
  - 1. Horizontal Unit: Provide Recessed type as shown. Provide supports and vibration isolators for horizontal units as recommended by the manufacturer.
    - a. Recessed Units: Provide hinged access door with stamped integral air inlet grille and outlet duct collar.

E. Fans: Centrifugal, forward curved, double width type wheels, galvanized steel or polyester resin construction, statically and dynamically balanced, direct driven.

1. Motors: Premium efficiency, 3-speed permanent split capacitor type with integral thermal overload protection, for operation at not more than 1200 RPM.
2. Provide a fan speed selector switch, with off, low, medium, and high positions. Switch shall have a set of auxiliary contacts which are open when the switch is in the "off" position and closed when the switch in any of the other positions. On ceiling-suspended horizontal and concealed units, switch shall be wall mounted.

F. Cooling Coils:

1. Hydronic: Copper tubes, 10 mm (three-eighths inch) minimum inside diameter, not less than 4.3 mm (0.017 inch) thick with copper or aluminum fins. Coils shall be pressure tested for bursting and strength in accordance with Underwriters Laboratories, Inc., requirements for pressure tested coils, and shall be designed to provide adequate heat transfer capacity. Provide manual air vent at high point of each coil and drain at each low point.

G. Piping Package: Factory furnished with unit by the manufacturer or field-installed by the contractor to fit control valves provided by the controls supplier. Submit manufacturer's detailed drawings of the piping in the end compartments for approval prior to fabrication of the piping packages. Provide ball stop valves on the supply and return pipes and balancing fittings on the return pipes.

H. Drain pans: Furnish galvanized steel with solderless drain connections and molded polystyrene foam insulating liner:

1. Auxiliary drain pan: Located under control valve and piping within the unit enclosure to prevent dripping.

I. Air Filter: Manufacturer's standard throwaway type, not less than 25 mm (1 inch) thick, MERV 7, supported to be concealed from sight and be tight fitting to prevent air by-pass. Filters shall have slide out frames and be easily replaced without removing enclosure or any part thereof.

J. Control valves and remote wall mounted space thermostats are to be field installed. Provide two-way modulating control valves unless shown or specified otherwise.

## **2.2 UNIT HEATERS**

- A. General: Horizontal or vertical discharge type for steam as indicated.
- B. Casing: Steel sheet, phosphatized to resist rust and finished in baked enamel. Provide hanger supports.
- C. Fan: Propeller type, direct driven by manufacturer's standard electric motor. Provide resilient mounting. Provide fan guard for horizontal discharge units.
- D. Discharge Air Control:
  - 1. Horizontal discharge: Horizontal, adjustable louvers.
- E. Steam Coil: Aluminum fins bonded to seamless copper tubing by mechanical expansion of the tubing, designed for 517 kPa (75 psig) steam working pressure.
- F. Controls: Provide field installed remote wall mounted line voltage electric space thermostats to control the unit fan. Provide an aquastat on steam units to prevent fan operation when the heating system is off.

## **2.3 RADIANT CEILING PANELS**

- A. Electric Heating Panels: UL listed, 0.55 mm (26 gage) steel backplate, 0.70 mm (24 gage) steel faceplate, with one inch thick insulation between plates and over radiant panel. Finish with two coats flat white baked-on polyester paint for lay-in installation in an exposed "T" suspended ceiling.
  - 1. Controls: Provide low voltage wall thermostats and required control transformers, relays and contactors for installation by the Electrical Contractor.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.
- B. Handle and install units in accordance with manufacturer's written instructions.
- C. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.
- D. Install fiberglass blanket insulation with a minimum R value of 8 above hydronic radiant panels.



### **3.2 OPERATIONAL TEST**

- A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

### **3.3 STARTUP AND TESTING**

- A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days' prior notice.

### **3.4 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.

### **3.5 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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**SECTION 26 05 11**  
**REQUIREMENTS FOR ELECTRICAL INSTALLATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, panelboards, and other items and arrangements for the specified items are shown on the drawings.
- C. 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 International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.
- B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

**1.3 TEST STANDARDS**

- A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified: Materials and equipment which:
  - a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
  - b. Are periodically inspected by a NRTL.
  - c. Bear a label, tag, or other record of certification.
4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

**1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)**

- A. Manufacturer's Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.
- B. Product Qualification:
  1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
  2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.

- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. Applicable publications listed in all Sections of Division 26 are 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.
- B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
1. Components of an assembled unit need not be products of the same manufacturer.
  2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  3. Components shall be compatible with each other and with the total assembly for the intended service.
  4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

1. The Government shall have the option of witnessing factory tests.  
The Contractor shall notify the Government through the COR a minimum of 15 working days prior to the manufacturer's performing the factory tests.
2. Four copies of certified test reports shall be furnished to the COR two weeks prior to final inspection and not more than 90 days after completion of the tests.
3. When materials and equipment fail factory tests, and re-testing and re-inspection is required, the Contractor shall be liable for all additional expenses for the Government to witness re-testing.

**1.7 VARIATIONS FROM CONTRACT REQUIREMENTS**

- A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

**1.8 MATERIALS AND EQUIPMENT PROTECTION**

- A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
  2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
  3. Damaged equipment shall be repaired or replaced, as determined by the COR.
  4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
  5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

## **1.9 WORK PERFORMANCE**

- A. All electrical work shall comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, 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. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
  - 1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
  - 2. Before initiating any work, a job specific work plan must be developed by the Contractor with a peer review conducted and documented by the COR and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
  - 3. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the COR.
- 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 panelboards, cabinets, motor controllers, fused and non-fused safety switches, separately enclosed circuit breakers, individual breakers, 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 NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm<sup>2</sup>), required PPE category and description including the glove rating, voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches),



prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

#### **1.12 SUBMITTALS**

- A. Submit to the COR in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.
- C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
  - 1. Mark the submittals, "SUBMITTED UNDER SECTION\_\_\_\_\_".
  - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
  - 3. Submit each section separately.
- E. The submittals shall include the following:
  - 1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
  - 2. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
  - 3. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:

1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
  - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
  - b. A control sequence describing start-up, operation, and shutdown.
  - c. Description of the function of each principal item of equipment.
  - d. Installation instructions.
  - e. Safety precautions for operation and maintenance.
  - f. Diagrams and illustrations.
  - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
  - h. Performance data.
  - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
  - j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

- G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the COR with one sample of each of the following:

1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.
4. Duct sealing compound.
5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

#### **1.13 SINGULAR NUMBER**

- A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

#### **1.14 POLYCHLORINATED BIPHENYL (PCB) EQUIPMENT**

- A. This project requires the removal, transport, and disposal of electrical equipment containing Polychlorinated Biphenyls (PCB) in accordance with the Federal Toxic Substances Control Act (TSCA).
- B. The equipment to be removed is shown on the drawings.
- C. The selective demolition shall be in accordance with Section 02 41 00, DEMOLITION.

#### **1.15 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. Repair, replacement, and retesting shall be accomplished at no additional cost to the Government.

**1.16 WARRANTY**

- A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

**1.17 INSTRUCTION**

- A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.
- B. Furnish the services of competent instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be trained in operating theory as well as practical operation and maintenance procedures.
- C. A training schedule shall be developed and submitted by the Contractor and approved by the COR at least 30 days prior to the planned training.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

- - - END - - -

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:  
Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

**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

## 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:

208/120 V	Phase	480/277 V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

6. Lighting circuit "switch legs", and 3-way and 4-way switch "traveling wires," shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COR.
7. Color code for isolated power system wiring shall be in accordance with the NEC.

## **2.2 SPLICES**

- A. Splices shall be in accordance with NEC and UL.
- B. Above Ground Splices for No. 10 AWG and Smaller:
  1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
  2. The integral insulator shall have a skirt to completely cover the stripped conductors.
  3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.
- C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
  1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
  2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  3. Splice and insulation shall be product of the same manufacturer.
  4. All bolts, nuts, and washers used with splices shall be zinc-plated steel.
- D. Above Ground Splices for 250 kcmil and Larger:
  1. Long barrel "butt-splice" or "sleeve" type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
  2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  3. Splice and insulation shall be product of the same manufacturer.
- E. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.



## **2.3 CONNECTORS AND TERMINATIONS**

- A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
- B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
- C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be zinc-plated steel.

## **2.4 CONTROL WIRING**

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.
- 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 INSTALLATION IN MANHOLES**

- A. Train the cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.

### **3.3 SPLICE AND TERMINATION INSTALLATION**

- A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.
- B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

### **3.4 CONDUCTOR IDENTIFICATION**

- A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

### **3.5 FEEDER CONDUCTOR IDENTIFICATION**

- A. In each interior pullbox and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

### **3.6 EXISTING CONDUCTORS**

- A. Unless specifically indicated on the plans, existing conductors shall not be reused.

### **3.7 CONTROL WIRING INSTALLATION**

- A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.
- B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

### **3.8 CONTROL WIRING IDENTIFICATION**

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.
- D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

### 3.9 ACCEPTANCE CHECKS AND TESTS

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
1. Visual Inspection and Tests: Inspect physical condition.
  2. Electrical tests:
    - a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
    - b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.
    - c. Perform phase rotation test on all three-phase circuits.

- - - END - - -

**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.
- B. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:  
Low-voltage conductors.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

**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.
    - b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
  - 2. Test Reports:
    - a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COR.
  - 3. Certifications:
    - a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

## 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Society for Testing and Materials (ASTM):
- B1-07.....Standard Specification for Hard-Drawn Copper Wire
  - B3-07.....Standard Specification for Soft or Annealed Copper Wire
  - B8-11.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
- 81-83.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- D. National Fire Protection Association (NFPA):
- 70-11.....National Electrical Code (NEC)
  - 70E-12.....National Electrical Safety Code
  - 99-12.....Health Care Facilities
- 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

## PART 2 - PRODUCTS

### 2.1 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.
- B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.

C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

D. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

## **2.2 GROUND CONNECTIONS**

A. Above Grade:

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

## **2.3 EQUIPMENT RACK AND CABINET GROUND BARS**

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks. Ground bars shall have minimum dimensions of 6.3 mm (0.25 inch) thick x 19 mm (0.75 inch) wide, with length as required or as shown on the drawings. Provide insulators and mounting brackets.

## **2.4 GROUND TERMINAL BLOCKS**

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

## **2.5 GROUNDING BUS BAR**

- A. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x 100 mm (4 inches) high in cross-section, length as shown on the drawings, with hole size, quantity, and spacing per detail shown on the drawings. Provide insulators and mounting brackets.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Install grounding equipment in accordance with the NEC, as shown on the drawings, and as specified herein.
- B. System Grounding:
  - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.
  - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

### **3.2 INACCESSIBLE GROUNDING CONNECTIONS**

- A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

### **3.3 RACEWAY**

- A. Conduit Systems:
  - 1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
  - 2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
  - 3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.



4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.
- B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.
- C. Boxes, Cabinets, Enclosures, and Panelboards:
  1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
  2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
- D. Wireway Systems:
  1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
  2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
  3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
- E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.
- F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

### **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.
- B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- - - END - - -

**SECTION 26 05 33**  
**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

**1.2 RELATED WORK**

- A. Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets.
- B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.
- C. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.
- D. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.
- E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- A. Manufacturer's Literature and Data: Showing each cable type and rating. The specific item proposed and its area of application shall be identified on the catalog cuts.
- B. Shop Drawings:
  - 1. Size and location of main feeders.
  - 2. Size and location of panels and pull-boxes.
  - 3. Layout of required conduit penetrations through structural elements.

C. Certifications:

1. Two weeks prior to the final inspection, submit four copies of the following certifications to the COR:
  - a. Certification by the manufacturer that the material conforms to the requirements of the drawings and specifications.
  - b. Certification by the contractor that the material has been properly installed.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American 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):
  - 70-08.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
  - 1-05.....Flexible Metal Conduit
  - 5-04.....Surface Metal Raceway and Fittings
  - 6-07.....Electrical Rigid Metal Conduit - Steel
  - 50-95.....Enclosures for Electrical Equipment
  - 360-093.....Liquid-Tight Flexible Steel Conduit
  - 467-07.....Grounding and Bonding Equipment
  - 514A-04.....Metallic Outlet Boxes
  - 514B-04.....Conduit, Tubing, and Cable Fittings
  - 514C-96.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
  - 651-05.....Schedule 40 and 80 Rigid PVC Conduit and Fittings
  - 651A-00.....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-2-03.....Electrical Polyvinyl Chloride (PVC) Tubing and  
Conduit

TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and  
Tubing

FB1-07.....Fittings, Cast Metal Boxes and Conduit Bodies  
for Conduit, Electrical Metallic Tubing and  
Cable

**PART 2 - PRODUCTS**

**2.1 MATERIAL**

A. Conduit Size: In accordance with the NEC, but not less than 0.5 in [13 mm] unless otherwise shown. Where permitted by the NEC, 0.5 in [13 mm] flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Rigid steel: Shall conform to UL 6 and ANSI C80.1.
2. Rigid intermediate steel conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
3. Electrical metallic tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 4 in [105 mm] and shall be permitted only with cable rated 600 V or less.
4. Flexible galvanized steel conduit: Shall conform to UL 1.
5. Liquid-tight flexible metal conduit: Shall conform to UL 360.
6. Surface metal raceway: Shall conform to UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC 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.
  - e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
3. Flexible steel conduit fittings:
- a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
  - b. Clamp-type, with insulated throat.
4. Liquid-tight flexible metal conduit fittings:
- a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
5. Surface metal raceway fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
6. Expansion and deflection couplings:
- a. Conform to UL 467 and UL 514B.
  - b. Accommodate a 0.75 in [19 mm] deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

- c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
  - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
- 1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
  - 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
  - 3. Multiple conduit (trapeze) hangers: Not less than 1.5 x 1.5 in [38 mm x 38 mm], 12-gauge steel, cold-formed, lipped channels; with not less than 0.375 in [9 mm] 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. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
  - 3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
  - 4. 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.
- F. Wireways: Equip with hinged covers, except where removable covers are shown. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

### **PART 3 - EXECUTION**

#### **3.1 PENETRATIONS**

A. Cutting or Holes:

1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COR prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by the COR as required by limited working space.

- 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, as shown, and as specified herein.
- B. Essential (Emergency) raceway systems shall be entirely independent of other raceway systems, except where shown on drawings.
- 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 undamaged material.
  4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
  5. Cut square, ream, remove burrs, and draw up tight.
  6. Independently support conduit at 8 ft [2.4 M] on centers. Do not use other supports, i.e., suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts.
  7. Support within 12 in [300 mm] of changes of direction, and within 12 in [300 mm] of each enclosure to which connected.
  8. Close ends of empty conduit with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
  9. Conduit installations under fume and vent hoods are prohibited.



10. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
11. 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 approved by the COR.

### 3.3 CONCEALED WORK INSTALLATION

A. In Concrete:

1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only:
  - a. Where shown on the structural drawings.
  - b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 3 in [75 mm] thick is prohibited.
  - a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
  - b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
  - c. Install conduits approximately in the center of the slab so that there will be a minimum of 0.75 in [19 mm] of concrete around the conduits.

5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors above 600 V: Rigid steel. Mixing different types of conduits indiscriminately in the same system is prohibited.
2. Conduit for conductors 600 V and below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 6 ft [1.8 M] of flexible metal conduit extending from a junction box to the fixture.
5. Tightening setscrews with pliers is prohibited.

**3.4 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors above 600 V: Rigid steel. Mixing different types of conduits indiscriminately in the system is prohibited.
- C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the system is prohibited.
- D. Align and run conduit parallel or perpendicular to the building lines.
- E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- F. Support horizontal or vertical runs at not over 8 ft [2.4 M] intervals.
- G. Surface metal raceways: Use only where shown.
- H. Painting:
  1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
  2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 2 in [50 mm] high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 20 ft [6 M] intervals in between.

### **3.5 HAZARDOUS LOCATIONS**

- A. Use rigid steel conduit only, notwithstanding requirements otherwise specified in this or other sections of these specifications.
- B. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

### **3.6 WET OR DAMP LOCATIONS**

- A. Unless otherwise shown, use conduits of rigid steel or IMC.
- 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. Unless otherwise shown, use rigid steel or IMC conduit within 5 ft [1.5 M] of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

### **3.7 MOTORS AND VIBRATING EQUIPMENT**

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water. Provide a green equipment grounding conductor with flexible metal conduit.

### **3.8 EXPANSION JOINTS**

- A. Conduits 3 in [75 mm] and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 3 in [75 mm] with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5 in [125 mm] vertical drop midway between the ends. Flexible conduit shall have a bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for conduits 15 in [375 mm] and larger are acceptable.

C. Install expansion and deflection couplings where shown.

### **3.10 CONDUIT SUPPORTS, INSTALLATION**

- 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 200 lbs [90 kg]. Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
  - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
  - 2. Existing Construction:
    - a. Steel expansion anchors not less than 0.25 in [6 mm] bolt size and not less than 1.125 in [28 mm] embedment.
    - b. Power set fasteners not less than 0.25 in [6 mm] diameter with depth of penetration not less than 3 in [75 mm].
    - c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

### 3.11 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
  - 1. Flush-mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 24 in [600 mm] center-to-center lateral spacing shall be maintained between boxes.
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 in [100 mm] square x 2.125 in [55 mm] deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."
- G. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -



**SECTION 26 08 00**

**COMMISSIONING OF ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 26.
- B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

**1.2 RELATED WORK**

- A. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

**1.3 SUMMARY**

- A. This Section includes requirements for commissioning the Facility electrical systems, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.
- B. Refer to Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

**1.4 DEFINITIONS**

- A. Refer to Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS for definitions.

**1.5 COMMISSIONED SYSTEMS**

- A. Commissioning of a system or systems specified in Division 26 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 26, is required in cooperation with the VA and the Commissioning Agent.
- B. The Facility electrical systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements.

## **1.6 SUBMITTALS**

- A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor.
- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.1 CONSTRUCTION INSPECTIONS**

- A. Commissioning of Electrical systems will require inspection of individual elements of the electrical systems construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning plan to schedule electrical systems inspections as required to support the Commissioning Process.

### **3.2 PRE-FUNCTIONAL CHECKLISTS**

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader



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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 CONTRACTOR'S TESTS**

- A. Contractor tests as required by other sections of Division 26 shall be scheduled and documented. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

### **3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING**

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS, for additional details.

### 3.5 TRAINING OF VA PERSONNEL

- A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00. The instruction shall be scheduled in coordination with the VA Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and Division 26 Sections for additional Contractor training requirements.

- - - END - - -

**SECTION 26 09 23**  
**LIGHTING CONTROLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation and connection of the lighting controls.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- D. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Product Data: For each type of lighting control, submit the following information.
1. Manufacturer's catalog data.
  2. Wiring schematic and connection diagram.
  3. Installation details.
- C. Manuals:
1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
  2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the Resident Engineer.
- D. Certifications:
1. Two weeks prior to final inspection, submit four copies of the following certifications to the Resident Engineer:
    - a. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested.

### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Green Seal (GS):  
GC-12.....Occupancy Sensors
- C. Illuminating Engineering Society of North America (IESNA):  
IESNA LM-48.....Guide for Calibration of Photoelectric Control Devices
- D. National Electrical Manufacturer's Association (NEMA)  
C136.10.....American National Standard for Roadway Lighting Equipment-Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing  
ICS-1.....Standard for Industrial Control and Systems General Requirements  
ICS-2.....Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment  
ICS-6.....Standard for Industrial Controls and Systems Enclosures
- E. Underwriters Laboratories, Inc. (UL):  
20.....Standard for General-Use Snap Switches  
773.....Standard for Plug-In Locking Type Photocontrols for Use with Area Lighting  
773A .....Nonindustrial Photoelectric Switches for Lighting Control  
98.....Enclosed and Dead-Front Switches  
917.....Clock Operated Switches

## **PART 2 - PRODUCTS**

### **2.1 ELECTRONIC TIME SWITCHES**

- A. Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
  - 1. Contact Configuration: SPST.
  - 2. Contact Rating: 20-A ballast load, 120/240-V ac.
  - 3. Time Clock: Capable of switching a load on at and off at preset times each day. Additionally, it shall be programmable to a fixed on/off weekly schedule.
  - 4. Battery Backup: For schedules and time clock.

### **2.2 ELECTROMECHANICAL-DIAL TIME SWITCHES**

- A. Electromechanical-dial time switches; complying with UL 917.
  - 1. Contact Configuration: SPST.
  - 2. Contact Rating: 20-A ballast load, 120/240-V ac.
  - 3. Wound-spring reserve carryover mechanism to keep time during power failures.

### **2.3 TIMER SWITCHES**

- A. Digital switches with backlit LCD display, 120/277 volt rated, fitting as a replacement for standard wall switches.
  - 1. Compatibility: Compatible with all ballasts.
  - 2. Warning: Audible warning to sound during the last minute of "on" operation.
  - 3. Time-out: Adjustable from 5 minutes to 12 hours.
  - 4. Faceplate: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

### **2.4 INDOOR OCCUPANCY SENSORS**

- A. Wall- or ceiling-mounting, solid-state units with a power supply and relay unit, suitable for the environmental conditions in which installed.
  - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a 1 to 15 minute adjustable time delay for turning lights off.
  - 2. Sensor Output: Contacts rated to operate the connected relay. Sensor shall be powered from the relay unit.
  - 3. Relay Unit: Dry contacts rated for 20A ballast load at 120V and 277V, for 13A tungsten at 120V, and for 1 hp at 120V.

4. Mounting:
  - a. Sensor: Suitable for mounting in any position on a standard outlet box.
  - b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Manual/automatic selector switch.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc [21.5 to 2152 lx]; keep lighting off when selected lighting level is present.
9. Faceplate for Wall-Switch Replacement Type: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.
- B. Dual-technology Type: Ceiling mounting; combination PIR and ultrasonic detection methods, field-selectable.
  1. Sensitivity Adjustment: Separate for each sensing technology.
  2. Detector Sensitivity: Detect occurrences of 6-inch [150mm] minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. [232 sq. cm], and detect a person of average size and weight moving not less than 12 inches [305 mm] in either a horizontal or a vertical manner at an approximate speed of 12 inches/s [305 mm/s].
  3. Detection Coverage: as scheduled on drawings.

## **2.5 LIGHTING CONTROL PANEL - RELAY TYPE**

- A. Controller: Comply with UL 508; programmable, solid-state, astronomic 365-day control unit with non-volatile memory, mounted in preassembled relay panel with low-voltage-controlled, latching-type, single-pole lighting circuit relays. Controller shall be capable of receiving inputs from sensors and other sources, and capable of timed overrides and/or blink-warning on a per-circuit basis. Where indicated, a limited number of digital or analog, low-voltage control-circuit outputs shall be supported by control unit and circuit boards associated with relays.
- B. Cabinet: Steel with hinged, locking door. Barriers separate low-voltage and line-voltage components.
- C. Directory: Identifies each relay as to load controlled.
- D. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.

- E. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20 A, 125-V ac for tungsten filaments and 20 A, 277-V ac for ballasts, 50,000 cycles at rated capacity.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.
- B. Aim outdoor photocell switch according to manufacturer's recommendations. Set adjustable window slide for 1 footcandle photocell turn-on.
- C. Aiming for wall-mounted and ceiling-mounted motion sensor switches shall be per manufacturer's recommendations.
- D. Set occupancy sensor "on" duration to 15 minutes.
- E. Locate light level sensors as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for the scheduled light level at the typical work plane for that area.
- F. Label time switches and contactors with a unique designation.

#### **3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations.
- B. Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.
- C. Test for full range of dimming ballast and dimming controls capability. Observe for visually detectable flicker over full dimming range.
- D. Test occupancy sensors for proper operation. Observe for light control over entire area being covered.
- E. Program lighting control panels per schedule on drawings.

#### **3.3 FOLLOW-UP VERIFICATION**

- A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting control devices are in good operating condition and properly performing the intended function.

- - - E N D - - -





**SECTION 26 27 26**  
**WIRING DEVICES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of wiring devices.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.
- E. Section 26 51 00, INTERIOR LIGHTING: Fluorescent ballasts and LED drivers for use with manual dimming controls.

**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.
    - b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.

2. Manuals:

- a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.
  - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
- a. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.
  - b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. National Fire Protection Association (NFPA):
- 70-11.....National Electrical Code (NEC)
  - 99-12.....Health Care Facilities
- C. National Electrical Manufacturers Association (NEMA):
- WD 1-10.....General Color Requirements for Wiring Devices
  - WD 6-08 .....Wiring Devices - Dimensional Specifications
- D. Underwriter's Laboratories, Inc. (UL):
- 5-11.....Surface Metal Raceways and Fittings
  - 20-10.....General-Use Snap Switches
  - 231-07.....Power Outlets
  - 467-07.....Grounding and Bonding Equipment
  - 498-07.....Attachment Plugs and Receptacles
  - 943-11.....Ground-Fault Circuit-Interrupters
  - 1449-07.....Surge Protective Devices
  - 1472-96.....Solid State Dimming Controls

## **PART 2 - PRODUCTS**

### **2.1 RECEPTACLES**

- A. General: All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.
  - 1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
  - 2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.
- B. Duplex Receptacles: Hospital-grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, NEMA 5-20R, with break-off feature for two-circuit operation.
  - 1. Bodies shall be ivory in color.
  - 2. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring.
    - a. Ground fault interrupter shall consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or - 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
    - b. Ground Fault Interrupter Duplex Receptacles (not hospital-grade) shall be the same as ground fault interrupter hospital-grade receptacles except for the hospital-grade listing.
  - 3. Duplex Receptacles (not hospital grade): Shall be the same as hospital grade duplex receptacles except for the hospital grade listing and as follows.
    - a. Bodies shall be brown nylon.
- C. Receptacles; 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.

## **2.2 TOGGLE SWITCHES**

- A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be ivory in color unless otherwise specified or shown on the drawings.
  - 1. Switches installed in hazardous areas shall be explosion-proof type in accordance with the NEC and as shown on the drawings.
  - 2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plaster ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
  - 3. Switches shall be rated 20 amperes at 120-277 Volts AC.

## **2.3 WALL PLATES**

- A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.
- B. Color shall be ivory unless otherwise specified.
- C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
- D. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.
- E. Duplex Receptacles on Emergency Circuit: Wall plates shall be red nylon with the word "EMERGENCY" engraved in 6 mm (1/4 inch) white letters.  
Wall plates shall be type 302 stainless steel, with the word "EMERGENCY" engraved in 6 mm (1/4 inch) red letters.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Installation shall be in accordance with the NEC and as shown as on the drawings.
- B. Install wiring devices after wall construction and painting is complete.
- C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.
- D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.

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- E. Provide barriers in multigang outlet boxes to comply with the NEC.
- F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.
- G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.
- H. Install wall switches 1.2 M (48 inches) above floor, with the toggle OFF position down.
- I. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.
- J. Install vertically mounted receptacles with the ground pin up. Install horizontally mounted receptacles with the ground pin to the right.
- K. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.
- L. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

### 3.2 ACCEPTANCE CHECKS AND TESTS

- A. Perform manufacturer's required field checks in accordance with the manufacturer's recommendations. In addition, include the following:
  1. Visual Inspection and Tests:
    - a. Inspect physical and electrical condition.
    - b. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.
    - c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
    - d. Test GFCI receptacles.
  2. Healthcare Occupancy Tests:
    - a. Test hospital grade receptacles for retention force per NFPA 99.

- - - END - - -

**SECTION 26 29 21**  
**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of fused and unfused disconnect switches (indicated as switches in this section), and separately-enclosed circuit breakers for use in electrical systems rated 600 V and below.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:  
Low-voltage conductors.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:  
Requirements for personnel safety and to provide a low impedance path for possible ground faults.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

**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.
  - b. Submit the following data for approval:
    - 1) Electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, fuses, circuit breakers, wiring and connection diagrams, accessories, and device nameplate data.

2. Manuals:
  - a. Submit complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering fuses, circuit breakers, and replacement parts.
    - 1) Include schematic diagrams, with all terminals identified, matching terminal identification in the enclosed switches and circuit breakers.
    - 2) Include information for testing, repair, troubleshooting, assembly, and disassembly.
  - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
  - a. Certification by the manufacturer that the enclosed switches and circuit breakers conform to the requirements of the drawings and specifications.
  - b. Certification by the Contractor that the enclosed switches and circuit breakers have been properly installed, adjusted, and tested.

#### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. International Code Council (ICC):  
IBC-12.....International Building Code
- C. National Electrical Manufacturers Association (NEMA):  
FU 1-07.....Low Voltage Cartridge Fuses  
KS 1-06.....Enclosed and Miscellaneous Distribution  
Equipment Switches (600 Volts Maximum)
- D. National Fire Protection Association (NFPA):  
70-11.....National Electrical Code (NEC)



E. Underwriters Laboratories, Inc. (UL):

98-07.....Enclosed and Dead-Front Switches

248-00.....Low Voltage Fuses

489-09.....Molded Case Circuit Breakers and Circuit  
Breaker Enclosures

**PART 2 - PRODUCTS**

**2.1 FUSED SWITCHES RATED 600 AMPERES AND LESS**

- A. Switches shall be in accordance with NEMA, NEC, UL, as specified, and as shown on the drawings.
- B. Shall be NEMA classified General Duty (GD) for 240 V switches, and NEMA classified Heavy Duty (HD) for 480 V switches.
- C. Shall be horsepower (HP) rated.
- D. Shall have the following features:
  - 1. Switch mechanism shall be the quick-make, quick-break type.
  - 2. Copper blades, visible in the open position.
  - 3. An arc chute for each pole.
  - 4. External operating handle shall indicate open and closed positions, and have lock-open padlocking provisions.
  - 5. Mechanical interlock shall permit opening of the door only when the switch is in the open position, defeatable to permit inspection.
  - 6. Fuse holders for the sizes and types of fuses specified.
  - 7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
  - 8. Ground lugs for each ground conductor.
  - 9. Enclosures:
    - a. Shall be the NEMA types shown on the drawings.
    - b. Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions.
    - c. Shall be finished with manufacturer's standard gray baked enamel paint over pretreated steel.

**2.2 UNFUSED SWITCHES RATED 600 AMPERES AND LESS**

- A. Shall be the same as fused switches, but without provisions for fuses.

**2.3 FUSED SWITCHES RATED OVER 600 AMPERES TO 1200 AMPERES**

- A. Shall be the same as fused switches, and shall be NEMA classified Heavy Duty (HD).

## **2.4 MOTOR RATED TOGGLE SWITCHES**

- A. Type 1, general purpose for single-phase motors rated up to 1 horsepower.
- B. Quick-make, quick-break toggle switch with external reset button and thermal overload protection matched to nameplate full-load current of actual protected motor.

## **2.5 CARTRIDGE FUSES**

- A. Shall be in accordance with NEMA FU 1.
- B. Feeders: Class RK1, time delay.
- D. Motor Branch Circuits: Class RK1, time delay.
- E. Other Branch Circuits: Class RK1, time delay

## **2.6 SEPARATELY-ENCLOSED CIRCUIT BREAKERS**

- A. Enclosures shall be the NEMA types shown on the drawings. Where the types are not shown, they shall be the NEMA type most suitable for the ambient environmental conditions.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. Installation shall be in accordance with the manufacturer's instructions, the NEC, as shown on the drawings, and as specified.
- B. Fused switches shall be furnished complete with fuses. Arrange fuses such that rating information is readable without removing the fuses.

## **3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests:
    - a. Compare equipment nameplate data with specifications and approved shop drawings.
    - b. Inspect physical, electrical, and mechanical condition.
    - c. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method.
    - d. Vacuum-clean enclosure interior. Clean enclosure exterior.

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### 3.3 SPARE PARTS

- A. Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fused disconnect switch installed on the project. Deliver the spare fuses to the COR.

- - - END - - -



**SECTION 26 51 00**  
**INTERIOR LIGHTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of the interior lighting systems. The terms "lighting fixture," "fixture," and "luminaire" are used interchangeably.

**1.2 RELATED WORK**

- A. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT: Disposal of lamps.
- B. Section 02 41 00, DEMOLITION: Removal and disposal of lamps and ballasts.
- C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- D. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- F. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

**1.3 QUALITY ASSURANCE**

- A. 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 the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
  - b. Material and construction details, including information on housing and optics system.
  - c. Physical dimensions and description.
  - d. Wiring schematic and connection diagram.
  - e. Installation details.
  - f. Energy efficiency data.

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):

C78.1-91.....Fluorescent Lamps - Rapid-Start Types -  
Dimensional and Electrical Characteristics

C78.376-01.....Chromaticity of Fluorescent Lamps

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

C635-07.....Manufacture, Performance, and Testing of Metal  
Suspension Systems for Acoustical Tile and Lay-  
in Panel Ceilings

D. Environmental Protection Agency (EPA):

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

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E. Federal Communications Commission (FCC):

CFR Title 47, Part 15...Radio Frequency Devices

CFR Title 47, Part 18...Industrial, Scientific, and Medical Equipment

F. Illuminating Engineering Society (IES):

LM-79-08.....Electrical and Photometric Measurements of  
Solid-State Lighting Products

LM-80-08.....Measuring Lumen Maintenance of LED Light  
Sources

LM-82-12.....Characterization of LED Light Engines and LED  
Lamps for Electrical and Photometric Properties  
as a Function of Temperature

G. Institute of Electrical and Electronic Engineers (IEEE):

C62.41-91.....Surge Voltages in Low Voltage AC Power Circuits

H. International Code Council (ICC):

IBC-12.....International Building Code

I. National Fire Protection Association (NFPA):

70-11.....National Electrical Code (NEC)

101-12.....Life Safety Code

J. National Electrical Manufacturer's Association (NEMA):

C82.1-04.....Lamp Ballasts - Line Frequency Fluorescent Lamp  
Ballasts

C82.2-02.....Method of Measurement of Fluorescent Lamp  
Ballasts

C82.4-02.....Lamp Ballasts - Ballasts for High-Intensity  
Discharge and Low-Pressure Sodium (LPS) Lamps  
(Multiple-Supply Type)

C82.11-11.....Lamp Ballasts - High Frequency Fluorescent Lamp  
Ballasts

LL-9-09.....Dimming of T8 Fluorescent Lighting Systems

SSL-1-10.....Electronic Drivers for LED Devices, Arrays, or  
Systems

K. Underwriters Laboratories, Inc. (UL):

496-08.....Lampholders

542-0599.....Fluorescent Lamp Starters

844-12.....Luminaires for Use in Hazardous (Classified)  
Locations

924-12.....Emergency Lighting and Power Equipment

935-01.....Fluorescent-Lamp Ballasts  
1029-94.....High-Intensity-Discharge Lamp Ballasts  
1029A-06.....Ignitors and Related Auxiliaries for HID Lamp  
                    Ballasts  
1598-08.....Luminaires  
1574-04.....Track Lighting Systems  
2108-04.....Low-Voltage Lighting Systems  
8750-09.....Light Emitting Diode (LED) Light Sources for  
                    Use in Lighting Products

## **PART 2 - PRODUCTS**

### **2.1 LIGHTING FIXTURES**

- A. Shall be in accordance with NFPA, UL, as shown on drawings, and as specified.
- B. Sheet Metal:
  - 1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
  - 2. Wireways and fittings shall be free of burrs and sharp edges, and shall accommodate internal and branch circuit wiring without damage to the wiring.
  - 3. When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.
  - 4. Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.
- C. Ballasts and lamps shall be serviceable while the fixture is in its normally installed position. Ballasts shall not be mounted to removable reflectors or wireway covers unless so specified.
- D. Lamp Sockets:
  - 1. Fluorescent: Single slot entry type, requiring a one-quarter turn of the lamp after insertion. Lampholder contacts shall be the biting edge type.
  - 2. Compact Fluorescent: 4-pin.
  - 3. High Intensity Discharge (HID): Porcelain.
- E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.



F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

G. Metal Finishes:

1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion-resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.

H. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

I. Light Transmitting Components for Fluorescent Fixtures:

1. Shall be 100 percent virgin acrylic.
2. Flat lens panels shall have not less than 3 mm (1/8 inch) of average thickness.
3. Unless otherwise specified, lenses, reflectors, diffusers, and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction without distortion or cracking.

## **2.2 BALLASTS**

A. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V), electronic programmed-start type, designed for type and quantity of lamps indicated. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated. Ballasts shall include the following features:

1. Lamp end-of-life detection and shutdown circuit (T5 lamps only).
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion (THD): 10 percent or less.

5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. Ballast Factor: 0.87 or higher unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. EMR/RFI Interference: Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
11. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
12. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.

### 2.3 LAMPS

#### A. Linear and U-shaped T5 and T8 Fluorescent Lamps:

1. Except as indicated below, lamps shall be low-mercury energy saving type, have a color temperature between 3500° and 4100°K, a Color Rendering Index (CRI) equal or greater than 80, average rated life equal to or greater than 24,000 hours when used with an instant start ballast and 30,000 hours when used with a programmed or rapid start ballast (based on 3 hour starts), and be suitable for use with dimming ballasts, unless otherwise indicated.
  - a. Over the beds in Intensive Care, Coronary Care, Recovery, Life Support, and Observation and Treatment areas; Electromyographic, Autopsy (Necropsy), Surgery, and certain dental rooms (Examination, Oral Hygiene, Oral Surgery, Recovery, Labs, Treatment, and X-Ray) use color corrected lamps having a CRI of

85 or above and a correlated color temperature between 5000 and 6000°K, as shown on the drawings.

b. Other areas as shown on the drawings.

2. Lamps shall comply with EPA Toxicity Characteristic Leachate Procedure (TCLP) requirements.

#### **2.4 LED EXIT LIGHT FIXTURES**

- A. Exit light fixtures shall meet applicable requirements of NFPA and UL.
- B. Housing and door shall be die-cast aluminum.
- C. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.
- D. Finish shall be satin or fine-grain brushed aluminum.
- E. There shall be no radioactive material used in the fixtures.
- F. Fixtures:
  - 1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.
  - 2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
  - 3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.
- G. Voltage: Multi-voltage (120 - 277V).

#### **2.5 LED LIGHT FIXTURES**

- A. General:
  - 1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
  - 2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
  - 3. LED drivers shall include the following features unless otherwise indicated:
    - a. Minimum efficiency: 85% at full load.
    - b. Minimum Operating Ambient Temperature: -20° C. (-4° F.)
    - c. Input Voltage: 120 - 277V (±10%) at 60 Hz.

- d. Integral short circuit, open circuit, and overload protection.
- e. Power Factor:  $\geq 0.95$ .
- f. Total Harmonic Distortion:  $\leq 20\%$ .
- g. Comply with FCC 47 CFR Part 15.
- 4. LED modules shall include the following features unless otherwise indicated:
  - a. Comply with IES LM-79 and LM-80 requirements.
  - b. Minimum CRI 80 and color temperature 3000° K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
  - c. Minimum Rated Life: 50,000 hours per IES L70.
  - d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.
- B. LED Downlights:
  - 1. Housing, LED driver, and LED module shall be products of the same manufacturer.
- C. LED Troffers:
  - 1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
  - 2. Housing, LED driver, and LED module shall be products of the same manufacturer.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Installation shall be in accordance with the NEC, manufacturer's instructions, and as shown on the drawings or specified.
- B. Align, mount, and level the lighting fixtures uniformly.
- C. Lighting Fixture Supports:
  - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
  - 2. Shall maintain the fixture positions after cleaning and relamping.
  - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

4. Hardware for recessed fluorescent fixtures:
  - a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.
  - b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.
5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:
  - a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 6 mm (1/4 inch) secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
  - b. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 6 mm (1/4 inch) studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 6 mm (1/4 inch) toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.
6. Surface-mounted lighting fixtures:
  - a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6 mm (1/4 inch) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for

- the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25 kg (56 pounds) shall be supported directly from the building structure.
- b. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
  - c. Fixtures less than 6.8 kg (15 pounds) in weight and occupying less than 3715 sq cm (two square feet) of ceiling area may, when designed for the purpose, be supported directly from the outlet box when all the following conditions are met.
    - 1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.
    - 2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
    - 3) The outlet box is supported vertically from the building structure.
  - d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
7. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
- E. Furnish and install the new lamps as specified for all lighting fixtures installed under this project, and for all existing lighting fixtures reused under this project.
  - F. The electrical and ceiling trades shall coordinate to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges, etc.), to match the ceiling system being installed.
  - G. Bond lighting fixtures to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
  - H. At completion of project, replace all defective components of the lighting fixtures at no cost to the Government.

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- I. Dispose of lamps per requirements of Section 01 74 19, CONSTRUCTION  
WASTE MANAGEMENT, and Section 02 41 00, DEMOLITION.

### **3.2 ACCEPTANCE CHECKS AND TESTS**

A. Perform the following:

1. Visual Inspection:

- a. Verify proper operation by operating the lighting controls.
- b. Visually inspect for damage to fixtures, lenses, reflectors, diffusers, and louvers. Clean fixtures, lenses, reflectors, diffusers, and louvers that have accumulated dust, dirt, or fingerprints during construction.

2. Electrical tests:

- a. Exercise dimming components of the lighting fixtures over full range of dimming capability by operating the control device(s) in the presence of the COR. Observe for visually detectable flicker over full dimming range, and replace defective components at no cost to the Government.
- b. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless specifically recommended otherwise by the lamp manufacturer. Burn-in dimmed fluorescent and compact fluorescent lamps for at least 100 hours at full voltage, unless specifically recommended otherwise by the lamp manufacturer. Replace any lamps and ballasts which fail during burn-in.

### **3.3 FOLLOW-UP VERIFICATION**

- A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting systems are in good operating condition and properly performing the intended function.

- - - END - - -





**SECTION 27 05 33**  
**RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for all communications cabling unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

**1.2 RELATED WORK**

- A. Mounting board for communication closets: Section 06 10 00, ROUGH CARPENTRY.
- B. Sealing around penetrations to maintain the integrity of fire-rated construction: Section 07 84 00, FIRESTOPPING.
- C. Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building: Section 07 92 00, JOINT SEALANTS.
- D. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.

**1.3 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES, furnish the following:
- B. Shop Drawings:
  - 1. Size and location of panels and pull boxes.
  - 2. Layout of required conduit penetrations through structural elements.
  - 3. The specific item proposed and its area of application shall be identified on the catalog cuts.
- C. Certification: Prior to final inspection, deliver to the Resident Engineer or COR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

#### 1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):
- 70-05.....National Electrical Code (NEC)
- C. Underwriters Laboratories, Inc. (UL):
- 1-03.....Flexible Metal Conduit
- 5-01.....Surface Metal Raceway and Fittings
- 6-03.....Rigid Metal Conduit
- 50-03.....Enclosures for Electrical Equipment
- 360-03.....Liquid-Tight Flexible Steel Conduit
- 467-01.....Grounding and Bonding Equipment
- 514A-01.....Metallic Outlet Boxes
- 514B-02.....Fittings for Cable and Conduit
- 514C-05.....Nonmetallic Outlet Boxes, Flush-Device Boxes  
and Covers
- 651-02.....Schedule 40 and 80 Rigid PVC Conduit
- 651A-03.....Type EB and A Rigid PVC Conduit and HDPE  
Conduit
- 797-03.....Electrical Metallic Tubing
- 1242-00.....Intermediate Metal Conduit
- D. National Electrical Manufacturers Association (NEMA):
- TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and  
Tubing
- FB1-03.....Fittings, Cast Metal Boxes and Conduit Bodies  
for Conduit, Electrical Metallic Tubing and  
Cable

## **PART 2 - PRODUCTS**

### **2.1 MATERIAL**

- A. Conduit Size: In accordance with the NEC, but not less than 13 mm (1/2 inch) unless otherwise shown. Where permitted by the NEC, 13 mm (1/2 inch) flexible conduit may be used for tap connections to recessed lighting fixtures.
- B. Conduit:
  - 1. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.
  - 2. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.
  - 3. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.
  - 4. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inch) and shall be permitted only with cable rated 600 volts or less.
  - 5. Flexible galvanized steel conduit: Shall Conform to UL 1.
  - 6. Liquid-tight flexible metal conduit: Shall Conform to UL 360.
  - 7. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
  - 8. Surface metal raceway: Shall Conform to UL 5.
- C. Conduit Fittings:
  - 3. Electrical metallic tubing fittings:
    - a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
    - b. Only steel or malleable iron materials are acceptable.
    - c. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
    - d. Indent type connectors or couplings are prohibited.
    - e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

4. Flexible steel conduit fittings:
    - a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
    - b. Clamp type, with insulated throat.
  5. Liquid-tight flexible metal conduit fittings:
    - a. Fittings shall meet the requirements of UL 514B and ANSI/ 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.
  7. Surface metal raceway fittings: As recommended by the raceway manufacturer.
  8. Expansion and deflection couplings:
    - a. Conform to UL 467 and UL 514B.
    - b. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
    - c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
    - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
  2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
  3. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
  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. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
4. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

F. Wireways: Equip with hinged covers, except where removable covers are shown.

**PART 3 - EXECUTION**

**3.1 PENETRATIONS**

A. Cutting or Holes:

1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Resident Engineer or COR prior to drilling through structural sections.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Resident Engineer or COR as required by limited working space.

B. Fire Stop: Where conduits, wireways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS.

### **3.2 INSTALLATION, GENERAL**

#### **A. Install conduit as follows:**

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically continuous.
6. Independently support conduit at 8'0" on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
7. Support within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. Conduit installations under fume and vent hoods are prohibited.
10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
11. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
12. Do not use aluminum conduits in wet locations.
13. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

#### **B. Conduit Bends:**

1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

C. Layout and Homeruns:

1. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the Resident Engineer or COR.

**3.3 CONCEALED WORK INSTALLATION**

A. In Concrete:

1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only when the following occurs:
  - a. Where shown on the structural drawings.
  - b. As approved by the Resident Engineer or COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
  - a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
  - b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
  - c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.
5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors above 600 volts:
  - a. Rigid steel or rigid aluminum.
  - b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
2. Conduit for conductors 600 volts and below:
  - a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.

3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 1800 mm (six feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.

#### **3.4 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for conductors above 600 volts:
  1. Rigid steel or rigid aluminum.
  2. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
- C. Conduit for Conductors 600 volts and below:
  1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
- D. Align and run conduit parallel or perpendicular to the building lines.
- E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- F. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.
- G. Surface metal raceways: Use only where shown.
- H. Painting:
  1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
  2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.



### **3.5 EXPANSION JOINTS**

- A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.
- C. Install expansion and deflection couplings where shown.

### **3.6 CONDUIT SUPPORTS, INSTALLATION**

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
  - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
  - 2. Existing Construction:
    - a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
    - b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
    - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

### **3.7 BOX INSTALLATION**

- A. Boxes for Concealed Conduits:
  - 1. Flush mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

### **3.8 COMMUNICATION SYSTEM CONDUIT**

- A. Install the communication raceway system as shown on drawings.
- B. Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.
- C. All conduit ends shall be equipped with insulated bushings.
- D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.
- E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.
- F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

- G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.
- H. All empty conduits located in communication closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.
- I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

- J. Furnish and install 19 mm (3/4 inch) thick fire retardant plywood specified in Section 06 10 00, ROUGH CARPENTRY on the wall of communication closets where shown on drawings. Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.
- K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

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**SECTION 27 15 00**  
**COMMUNICATIONS HORIZONTAL CABLING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This Section specifies the furnishing, installing, certification, testing, and guaranty of a complete and operating Voice and Digital Cable Distribution System (here-in-after referred to as "*the System*"), and associated equipment and hardware to be installed in the VA here-in-after referred to as "*the Facility*". The System shall include, but not be limited to: equipment cabinets, interface enclosures,; necessary combiners, and necessary passive devices such as: cable "patch", "punch down", and cross-connector blocks or devices, voice and data distribution sub-systems, and associated hardware. The System shall additionally include, but not be limited to: telecommunication closets (TC); telecommunications outlets (TCO); copper distribution cables, connectors, "patch" cables, and/or "break out" devices.
- B. The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.
- C. The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.
- D. The VA Project Manager (PM) and/or if delegated, Resident Engineer (RE) are the approving authorities for all contractual and mechanical changes to the System. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the PM and/or the RE before proceeding with the change.
- E. System Performance:
1. At a minimum, the System shall be able to support the following voice and data operations for Category 6 Certified Telecommunication Service
  - b. Telecommunications Outlet (TCO):
    - 1) Voice:
      - a) Isolation (outlet-outlet): 24 dB.
      - b) Impedance: 600 Ohms, balanced (BAL).
      - c) Signal Level: 0 deciBel per mili-Volt (dBmV)  $\pm$  0.1 dBmV.

- d) System speed: 100 mBps, minimum.
- e) System data error: 10 to the -6 Bps, minimum.
- 2) Data:
  - a) Isolation (outlet-outlet): 24 dB.
  - b) Impedance: 600 Ohms, BAL.
  - c) Signal Level: 0 dBmV  $\pm$  0.1 dBmV.
  - d) System speed: 120 mBps, minimum.
  - e) System data error: 10 to the -8 Bps, minimum.

### 1.2 RELATED WORK

- A. Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. Specification Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS 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 text by basic designation only. Except for a specific date given the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date the system's submittal is technically approved by VA, shall be enforced.
- B. National Fire Protection Association (NFPA):

70	NATIONAL ELECTRICAL CODE (NEC)
75	Protection of Electronic Computer/Data Processing Equipment
77	Recommended Practice on Static Electricity
	Standard for Health Care Facilities
101	Life Safety Code
1221	Emergency Services Communication Systems

C. Underwriters Laboratories, Inc. (UL):

65	Wired Cabinets
96	Lightning Protection Components
96A	INSTALLATION REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEMS
467	Grounding and Bonding Equipment
497/497A/497B	PROTECTORS FOR PAIRED CONDUCTORS/ COMMUNICATIONS CIRCUITS/DATA COMMUNICATIONS AND FIRE ALARM CIRCUITS
884	Underfloor Raceways and Fittings

D. ANSI/EIA/TIA Publications:

568B	Commercial Building Telecommunications Wiring Standard
569B	Commercial Building Standard for Telecommunications Pathways and Spaces
606A	ADMINISTRATION STANDARD FOR THE TELECOMMUNICATIONS INFRASTRUCTURE OF COMMERCIAL BUILDINGS
607A	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings
758	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings

**1.5 SUBMITTALS**

A. Provide submittals in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES. The RE shall retain one copy for review and approval.

1. If the submittal is approved the RE shall retain one copy for Official Records and return three (3) copies to the Contractor.
2. If the submittal is disapproved, three (3) copies will be returned to the Contractor with a written explanation attached that indicates the areas the submittal deviated from the System specifications. The RE shall retain one copy for Official Records.

B. Documents: The submittal shall be separated into sections for each subsystem and shall contain the following:

1. Title page to include:

- a. VA Medical Center.
- b. Contractor's name, address, and telephone (including FAX) numbers.
- c. Date of Submittal.
- d. VA Project No.

2. Narrative Description of the system.

C. Test Equipment List:

1. The Contractor is responsible for furnishing all test equipment required to test the system in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment of accuracy better than the parameters to be tested.

2. The test equipment furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:

- a. Category 6 test set.

D. Certifications:

1. The Contractor shall have a registered RCDD professional review and seal all system shop drawings demonstrating industry standard design, installations and certifications of all structured cabling networks related to the installation.

2. Telecommunication Outlets: The Contractor shall clearly and fully indicate this category for each outlet location and compare the total count to the locations identified above as a part of the technical submittal. Additionally, the Contractor shall indicate the total number of spares.



## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT AND MATERIALS**

#### **A. System Requirements:**

1. The System shall provide the following minimum services that are designed in accordance with and supported by an Original Equipment Manufacturer (OEM), and as specified herein. The System shall provide continuous inter and/or intra-Facility voice and data service. The System shall be capacity sized so that loss of connectivity to external telephone systems shall not affect the Facilities operation in specific designated locations. The System shall:
  - a. Be a voice and data cable distribution system that is based on a physical "Star" Topology.
2. Cable Systems - Twisted Pair
  - a. General:

The distribution cable installation shall be fully coordinated with the Facility, the PM, the RE and the Contractor prior to the start of installation.
  - 2) The Contractor is responsible for complete knowledge of the space and cable pathways (i.e. equipment rooms, TCs, conduits, wireways, etc.) of the Facility. The Contractor shall at a minimum design and install the System using the Pathway Design Handbook H-088C3, TIA/EIA Telecommunications Building Wiring Standards, and Facility Chief of Information Resource Management's (IRM) instructions, as approved in writing by the PM and/or RE.
  - 3) The System cables shall be fully protected by cable duct, trays, wireways, conduit (rigid, thin wall, or flex), and when specifically approved, flexible innerduct. It is the responsibility of the Contractor to confirm all contract drawings and the Facility's physical layout to determine the necessary cable protective devices to be provided. If flexible innerduct is used, it shall be installed in the same manner as conduit.
  - 4) Some areas of this Facility may be considered "plenum". All wire and cable used in support of the installation in those areas (if any) shall be in compliance with national and local

codes pertaining to plenum environments. It is the responsibility of the Contractor to review the VA's cable and wire requirements with the RE and the IRM prior to installation to confirm the type of environment present at each location.

- 5) The System's cables shall be labeled on each end and been fully tested and certified in writing by the Contractor to the RE before proof of performance testing can be conducted. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs. Minimum test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges specified. The tests required for data cable must be made to guarantee the operation of this cable at not less than 10 mega (m) Hertz (Hz) full bandwidth, fully channel loaded and a Bit Error Rate of a minimum of  $10^{-6}$  at the maximum rate of speed. All cable installation and test records shall be made available at acceptance testing by the RE or Contractor and thereafter maintained in the Facility's Telephone Switch Room. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.
- A. Horizontal (or Station) Cabling (HC): The HC distribution cabling systems connects the distribution field of the voice and data HCCS, in a "Star" Topology, to each TCO or connector and as shown on the drawings via the sub-trunk system.
  - 1) Horizontal cables shall consist of insulated, UTP or STP conductors that are rated for Category 6 telecommunications service for voice and data systems.
  - 2) The number of UTP or STP distribution pairs dedicated to each floor from the HC shall be sufficient to accommodate all the horizontal voice and data circuits served by the distribution cable to each TCO.
    - a) A minimum of four pairs for voice shall be connected to the "right" side of the IDC (or 110A block) that the VCCS "input" connections appear in the RTC.

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- b) A minimum of two separate sets of four pairs each for data shall be connected to the "bottom" row of RJ45 jacks that the VCCS "input" connections appear in the RTC.
- 3) The horizontal cable length to the farthest system outlet shall be limited to a maximum of 90M (or 295 ft). These maximum lengths must be derated, adjusted and reduced to include cross-connection and distribution system losses. Additional TC(s) shall be provided on large floor areas of buildings to limit the horizontal distribution to a maximum of 90M (or 295 ft).
- 4) The splitting of pairs within a cable between different jacks shall not be permitted.
- 5) The installation of the HC shall conform to appropriate OEM recommendations and standards outlined herein. This requirement will insure adequate protection for Electro-Magnetic Interference (EMI) sources.
- 6) A system design where "looping" the HC distribution cables from room to room shall not be permitted.

B. System Performance:

- 1. At a minimum, the System shall be able to support the following voice and data operations for Category 6 Certified Telecommunication Service.

**2.3 TELECOMMUNICATIONS CLOSET REQUIREMENTS**

- A. Refer to VA Handbook H-088C3, Telephone System Requirements, for specific TC guidelines for size, power input, security, and backboard mounting requirements. It is the Contractors responsibility to ensure TC compliance with the System Requirements.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

#### **A. Product Delivery, Storage and Handling:**

1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The RE may inventory the cable, patch panels, and related equipment.
2. Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the RE.

#### **B. System Installation:**

1. After the contract's been awarded, and within the time period specified in the contract, the Contractor shall deliver the total system in a manner that fully complies with the requirements of this specification. The Contractor shall make no substitutions or changes in the System without written approval from the RE and PM.
2. The Contractor shall install all equipment and systems in a manner that complies with accepted industry standards of good practice, OEM instructions, the requirements of this specification, and in a manner which does not constitute a safety hazard. The Contractor shall insure that all installation personnel understands and complies with all the requirements of this specification.
3. Where TCOs are installed adjacent to each other, install one outlet for each instrument.

### **3.2 TESTS**

#### **A. Pretesting:**

1. Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.
2. Pretesting Procedure:
  - a. During the system pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the system performance requirements of this standard.
  - b. The Contractor shall pretest and verify that all System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present.

3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.

B. Acceptance Test: After the System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 30 days' written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a Government Representative and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance. The test shall verify that the total System meets the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

C. Performance Testing:

1. Perform Category 6 tests in accordance with ANSI/EIA/TIA-568-B.1 and ANSI/EIA/TIA-568-B.2. Test shall include the following: wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.
2. Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with ANSI/EIA/TIA-568-B.3.

### **3.3 TRAINING**

- A. Furnish the services of a factory-trained engineer or technician for a total of two four hour classes to instruct designated Facility IRM personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the System and equipment.
- B. Before the System can be accepted by the VA, this training must be accomplished. Training will be scheduled at the convenience of the Facilities Contracting Officer and Chief of Engineering Service.

### 3.4 WARRANTY

A. Comply with FAR clause 52.246-21, except that warranty shall be as follows:

1. The Contractor shall warranty that all installed material and equipment will be free from defects, workmanship, and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken possession of the building(s)), that certifies each item of equipment installed conforms to OEM published specifications.
2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. The Contractor and OEM shall provide this contact capability at no additional cost to the VA.
3. All Contractor installation, maintenance, and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
4. Additionally, the Contractor shall accomplish the following minimum requirements during the one year warranty period:
  - a. Response Time:
    - 1) The RE (or facility Contracting Officer if the facility has taken possession of the building[s]) are the Contractor's reporting and contact officials for the System trouble calls, during the warranty period.
    - 2) A standard workweek is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal Holidays.
    - 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
      - a) A routine trouble call within one working days of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.

- b) An emergency trouble call within 6 hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at anytime. Additionally, the loss of a minimum of 50 station or system lines shall be deemed as this type of a trouble call.
- 4) The Contractor shall respond on-site to a catastrophic trouble call within 4 hours of its report. A catastrophic trouble call is considered total system failure.
  - a) If a system failure cannot be corrected within four hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate system CSS or TCO equipment, or cables. The alternate equipment and/or cables shall be operational within four hours after the four hour trouble shooting time.
  - b) Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as a catastrophic trouble call if so determined by the RE or Facility Director. The RE or Facility Contracting Officer shall notify the Contractor of this type of trouble call at the direction of the Facilities Director.
- b. Required on-site visits during the one year warranty period
  - 1) The Contractor shall visit, on-site, for a minimum of eight hours, once every 12 weeks, during the warranty period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this SPEC.
    - a) The Contractor shall arrange all Facility visits with the RE or Facility Contracting Officer prior to performing the required maintenance visits.
    - b) The Contractor in accordance with the OEM's recommended practice and service intervals shall perform preventive maintenance during a non-busy time agreed to by the RE or Facility Contracting Officer and the Contractor.

- c) The preventive maintenance schedule, functions and reports shall be provided to and approved by the RE or Facility Contracting Officer.
- 2) The Contractor shall provide the RE or Facility Contracting Officer a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the RE with sample copies of these reports for review and approval at the beginning of the Total System Acceptance Test. The following reports are the minimum required:
  - a) Monthly Report: The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this warranty period to RE or Facilities Contracting Officer by the fifth working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and Systems for preventive and predictive maintenance
  - b) Contractor Log: The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.
- 3) The RE or Facility Contracting Officer shall provide the Facility Engineering Officer, two (2) copies of actual reports for evaluation.
  - a) The RE or Facility Contracting Officer shall ensure copies of these reports are entered into the System's official acquisition documents.
  - b) The Facilities Chief Engineer shall ensure copies of these reports are entered into the System's official technical as-installed documents.



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B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use, accidents, other vendor, contractor, owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the RE or Facility Contracting Officer in writing upon the discovery of these incidents. The RE or Facility Contracting Officer will investigate all reported incidents and render findings concerning any Contractor's responsibility.

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**SECTION 28 05 00**  
**COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This Section, Common Work Results for Electronic Safety and Security (ESS), applies to all sections of Division 28.
- B. Furnish and install fully-functional electronic safety and security cabling system(s), equipment and accessories in accordance with the specification and drawing(s). Capacities and ratings of cable and other items and arrangements for the specified items are shown on drawings.

**1.2 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
  - 1. Components of an assembled unit need not be products of the same manufacturer.
  - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  - 3. Components shall be compatible with each other and with the total assembly for the intended service.
  - 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
  - 1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the COR a minimum of 15 working days prior to the manufacturers making the factory tests.
  - 2. Four copies of certified test reports containing all test data shall be furnished to the COR prior to final inspection and not more than 90 days after completion of the tests.

3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

### **1.3 EQUIPMENT REQUIREMENTS**

- A. Where variations from the contract requirements are requested in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

### **1.4 EQUIPMENT PROTECTION**

- A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
  1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
  2. Damaged equipment shall be, as determined by the COR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
  3. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
  4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

### **1.5 WORK PERFORMANCE**

- A. Job site safety and worker safety is the responsibility of the contractor.
- B. For work on existing stations, arrange, phase and perform work to assure electronic safety and security service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

- D. Coordinate location of equipment and conduit with other trades to minimize interferences. See Section 01 33 23, , Product Data and Samples.

#### **1.6 EQUIPMENT INSTALLATION AND REQUIREMENTS**

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Inaccessible Equipment:
1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
  2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

#### **1.7 EQUIPMENT IDENTIFICATION**

- A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.

#### **1.8 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- 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, pictures, nameplate data and test reports as required.
2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

F. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
  - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
  - b. A control sequence describing start-up, operation, and shutdown.
  - c. Description of the function of each principal item of equipment.
  - d. Installation and maintenance instructions.
  - e. Safety precautions.

- f. Diagrams and illustrations.
  - g. Testing methods.
  - h. Performance data.
  - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
  - j. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
- G. Approvals will be based on complete submission of manuals together with shop drawings.
- H. After approval and prior to installation, furnish the COR with one sample of each of the following:
- 1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
  - 2. Each type of conduit and pathway coupling, bushing and termination fitting.
  - 3. Conduit hangers, clamps and supports.
  - 4. Duct-sealing compound.

#### **1.9 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.

#### **1.10 TRAINING**

- A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- B. Training shall be provided for the particular equipment or system as required in each associated specification.
- C. A training schedule shall be developed and submitted by the contractor and approved by the COR at least 30 days prior to the planned training.

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**SECTION 28 13 00**  
**PHYSICAL ACCESS CONTROL SYSTEM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 and all related specification sections shall apply to this section.
- B. Related Sections:
  - 1. Division 07 - Fire Stopping.
  - 2. Division 08 - Access Doors.
  - 3. Division 26 - Common Work Results for Electrical.
  - 4. Division 26 - Low Voltage Electrical Power Conductors and Cables.
  - 5. Division 26 - Grounding and Bonding for Electrical Systems
  - 6. Division 26 - Raceways and Boxes for Electrical Systems
  - 7. Division 28 - Common Work Results for Safety and Security Systems
  - 8. Division 28 - Video Surveillance System (CCTV)
- C. Reference Symbols:
  - 1. All device symbols are defined by the appropriate symbol schedules. Because of the scale of the drawings, symbols are shown on drawings as close as possible to the mounting location.
    - a. Contractor shall coordinate exact locations of all equipment with all site plan and architectural floor plan drawings as well as related specification sections for all affected systems and prior to submittal of any shop drawings.
- D. Abbreviations:
  - 1. Refer to Specification Section 28 05 00 for additional information.
- E. Definitions:
  - 1. Refer to Specification Section 28 05 00 for additional information.

**1.2 SUMMARY**

- A. The intent of this specification is to provide and install additional equipment to the Physical Access Control System (PACS) as indicated on the Contract drawings and/or herein specified. All work shall include all labor, materials, infrastructure, equipment, software and programming as required to provide a fully operational system as herein specified.
  - 1. The installation, performance, features, functions, software and programming modifications as specified herein as well as all related specification sections have been designed to offer the maximum system efficiency ease of operation, occupant safety and the protection of equipment as recommended by the design Professional.
    - a. Any deviations from the specified criteria shall be documented, reviewed and agreed to in writing by the VA's Contracting Officer and Design Professional prior to submission of bids. Refer to Division 1, Division 28 and related specification section for product substitutions.

2. It shall be the responsibility of the contractor to insure that the installed system meets or exceeds every standard set forth in these specifications. The contractor shall be responsible for providing a complete functional system, including all necessary components, devices, door hardware, active network electronics, electrical power, UPS units, software, programming, commissioning, testing and all appurtenances as well as the integration to all ancillary systems as necessary to provide a complete and fully operational system whether specifically included in this section or not.
  - a. The system shall consist of but not limited to all, equipment, devices, remote data gathering panels (DGP), network communications equipment, power supplies, conduits, cabling, software, programming, door hardware and all appurtenances as well as the integration of the Stations' Fire Alarm System and all related systems necessary to provide a complete operating system in accordance with the contract documents.
    - 1) The utilization of the facility's data network to support the distribution, performance and/or operation of the Physical Access Control System shall be strictly forbidden (other than where specified).
    - 2) The Contractor shall have a registered RCDD professional review and seal all system shop drawings demonstrating industry standard design, installations and certifications of all structured cabling networks related to the installation and operation of Physical Access Control System and all related electronic security systems.

- B. The installation of the PACS shall comply with the applicable sections of NFPA-70 National Electrical Code (Article 760). The system shall be electrically supervised and monitor the integrity of all conductors. In addition, the system shall meet all applicable requirements of NFPA Standard 72 for the integration to Protected Premises Signaling Systems, NFPA Standard 731 for the Installation of Electronic Premises Security Systems, HSPD-12 and Federal Information Processing Standard Publication 201 (FIPS 201).
1. The contractor and all sub-contractors for this work shall have read all of the General Conditions, Special Requirements, General Requirements and all applicable related specification sections and in the execution of all work shall be bound by all of the conditions and requirements therein.
- C. Prior to the submission of the Bid, any discrepancies or inconsistencies noted within these specifications and/or project drawings shall be brought to the immediate attention of the VA's Contracting Officer and Design Professional.
1. All equipment symbols are shown on drawings as close as possible to their intended location. Contractor shall coordinate the installation of all equipment, devices, controls, cabling and integration of any systems with all affected trades and system integrators. The Contractor shall document all coordination requirements at the time of shop drawing submissions.
  2. The Contract Drawings for this work are diagrammatic and intended to convey the extent, general arrangement and locations of the work. Because of the scale of these drawings, certain basic items such as access panels, conduits, cabinet sizes, penetration sleeves, pull boxes, backboxes and junction boxes may not be shown.
    - a. The contractor shall include all equipment, materials, components, device, controls and all appurtenances where required by code, by manufacturers' recommendations, and all related Contract Documents in order to ensure proper installation operation and integration of all components, equipment, devices and/or systems.

**D. THE CONTRACT DRAWINGS AND SPECIFICATIONS MAY NOT DEAL INDIVIDUALLY WITH EVERY PART, CONTROL, DEVICE, SOFTWARE OR PROGRAMMING, WHICH MAY BE REQUIRED TO PRODUCE THE EQUIPMENT AND/OR SYSTEM PERFORMANCE SPECIFIED OR AS NECESSARY FOR THE INSTALLATION AND INTEGRATION OF ALL DOOR HARDWARE AND SYSTEMS IN ACCORDANCE WITH ALL REQUIREMENTS OF THE CONTRACT DOCUMENTS.**

1. The Contractor shall include all such items and components, as required, for the complete and operational installation of all system components as defined by the Contract Documents, whether or not specifically indicated and/or specified.
  - a. Include such items, as required, for a complete operational system, whether or not specifically indicated.
  - b. Coordinate with other applicable trades in submittal of shop drawings and the installation of all systems.
  - c. Shop drawings shall detail space conditions to accommodate other concerned trades, subject to final review by the VA's Contracting Officer and Design Professional.
  - d. If installation of equipment, raceways, cable trays and/or conduit is performed prior to coordination with other trades, which interferes with work of other trades, make necessary changes to correct the condition at no additional cost to the Government.
  - e. The contractor shall be responsible for providing all wiring, connections to all equipment, circuits and devices as well as all coordination and programming for the integration of all electronic door hardware, ancillary systems impacting the operation of PACS. Refer to the contract drawings and related specification sections for additional information.

**1.3 SUBMITTALS**

**A. In addition to all requirements as specified by Specification Section 28 05 00 the physical access control systems shall also be provided in accordance with the following requirements:**

1. Provide a complete termination schedule of all door locations; indicate on the construction drawings door identifications corresponding with schedule.
2. Provide a complete alarm matrix for all door locations, indicate all associated alarm call-ups and camera pre-sets for every camera indicated on the contract drawings, include the related device activation and/or event for each pre-set and alarm call-up.
3. Provide a complete video surveillance camera integration schedule (where included) indicating each camera position relevant to door input location as well as a diagram indicating each termination position in the appropriate equipment cabinet and/or DGP.
4. Provide a complete integration schedule indicating all ancillary system locations as well as a diagram indicating each termination position in the appropriate equipment cabinet and/or DGP.

5. All integration protocols, communications connectivity and interface components to all, fire alarm, intrusion detection, emergency call, local door management alarm and video surveillance systems as well as any ancillary systems.
  - a. Wiring diagrams shall indicate all wiring for each field device as well as all wiring interconnections between each device and all controls and/or associated equipment, In addition, all electrical power connections with electrical circuit numbers shall be indicated to all equipment requiring electrical power.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURED PRODUCTS**

- A. Comply with all requirements of specification section 28 05 00.

### **2.2 MANUFACTURERS**

- A. Acceptable manufacturers for this project, providing full compliance with this specification section and all requirements of specification 28 05 00, shall be as follows:
  1. DSX
  2. Approved Equal
    - a. Substitutions will be considered providing compliance of all system performance as here in specified and in accordance with all substitution requirements of the Contract documents.
- B. Manufacturers listed as acceptable shall not negate the contractor's responsibility for providing the PACS system in accordance with all functions and performance requirements of this specification.

### **2.3 DOOR CONTROL DEVICES**

- A. Contactless Readers
  1. Furnish and install contactless or combination contactless\keypad type card readers as indicated on the Contract drawings. All contactless readers shall be ISO 14443A compliant operating at a minimum frequency of 13.56 MHz and shall conform to all requirements of HSPD-12, Federal Information Processing Standard Publication 201 (FIPS 201), National Institute of Standards and Technology (NIST) SP 800-116 and TWIC contactless reader specification guidelines as well as all NIST's "Controlled" security area assurance level requirements with a single-factor authentication modes(CHUID and CAK).
    - a. In addition to the required PIV-I contactless reader requirements all readers shall also be capable of accepting multiple card types such as PIV, CAC, CIV (a.k.a., PIV-C), TWIC and FRAC, as well as iCLASS, HID Prox cards and PKI-enabled smart cards.

- b. All contactless readers in order to comply with the "Controlled" assurance level (as defined in NIST SP 800-116) shall be connected (out at each door location) to a FIPS 201 compliant authentication module capable of performing the following single-factor authentication modes:
  - 1) CHUID Authentication - The authentication module shall test the signature on the PIV card holder unique identifier (CHUID) data object. The CHUID signature check shall ensure the card is authentic (it came from a valid issuer) and has integrity (it has not been altered). Since the CHUID is a "free read" and data can be transmitted unencrypted the signature check shall identify cards which have been counterfeited or altered.
  - 2) CAK Authentication - The authentication module shall perform a PKI challenge-response in addition to a signature check to validate the card authentication key (CAK). The challenge response test shall ensure that the public key in the Card Authentication Certificate is bound to the private key on the card. CAK authentication shall identify cards which have been counterfeited, altered, copied or cloned.
2. The contactless readers and authentication modules shall be UL listed 294 and ISO certified and shall Piv-Class series models as manufactured by HID or approved equal.

#### **2.4 DOOR CONTROL DEVICES**

- A. Provide duress alarm outlets where shown on the contract drawings and or herein specified. These outlets shall facilitate connection of duress device to head-end equipment and shall have two components, a surface mounted jack mounted under the desk surface, and a wall mounted (recessed) outlet.
  1. The contractor shall provide a single gang recessed back-box with conduit and wiring to the security alarm circuits for the wall-mounted jack and faceplate.
  2. The wall mounted jack shall be a Siemon model # MX-FP-S01-(XX) with modular jack model # MX-F-U2-ND or approved equals.
  3. The surface mounted jack shall be a Siemon model number SM1-04 with modular jack model number SMC-U2 or approved equals. The surface mounted jack shall be fastened to the desk/counter using screws. Using adhesive tape shall not be acceptable.
  4. The contractor shall provide 2 pair UTP wiring for the entire installation including a 2 pair UTP patch cord for connecting the surface mounted jack to the wall mounted jack. The length of the patch cord shall be field coordinated with the VA's Contracting Officer and Design Professional and the furniture layouts.
  5. All wiring shall be fastened to furniture and walls using wire straps fastened with screws. Using staples or adhesive tape shall not be acceptable. Coordinated with the VA's Contracting Officer and Design Professional and the furniture layouts prior to installation.

6. Provide desk or counter mounted duress alarms buttons for each duress alarm outlet indicated on the contract drawings. Desk or counter mounted duress alarms shall point identified and shall be operated with depressing two buttons simultaneously by the user. The duress alarm buttons shall be equipped with a key reset switch and a status indicator (green: Normal Mode, red: alarm mode). The alarms shall be mounted underneath desks/countertop within easy reach of the operator.

### **PART 3 - EXECUTION**

#### **3.1 EQUIPMENT PROTECTION**

- A. Comply with all requirements of specification section 28 05 00.
  1. Examine all physical and environmental conditions, door hardware specifications, equipment locations and wide area network connectivity requirements impacting the installation of the systems and report any unsatisfactory conditions in writing to the VA's Contracting Officer and Design Professional.

#### **3.2 WORK PERFORMANCE**

- A. In addition to all requirements as specified by Specification Section 28 05 00 the Access Control system shall also be provided in accordance with the following requirements:
  1. Prior to the final programming of any systems, the Contractor shall provide a review with the VA's Contracting Officer and Design Professional addressing all system features, functions, operations, integrated system responses, graphic maps and related operational programming.
    - a. Failure to provide this review and get final sign-off prior to programming shall result in any costs related to changes requested by the VA's Contracting Officer and Design Professional at no additional costs to the project.

#### **3.3 EQUIPMENT/CABLE INSTALLATION AND REQUIREMENTS**

- A. In addition to all requirements as specified by specification section 28 05 00 the PACS shall also be provided in accordance with the following requirements:
  1. All TCP\IP based physical access control system network cabling shall utilize Category-6 UTP cables and installed in accordance with the requirement of specification section 28 05 00. All cabling shall not contain any AC carrying conductors or non-associated system cables within the cable raceways\conduits or cable bundles.

- a. All PACS cabling installed on the exterior to the building and/or all cabling being routed from the facility to any remote location external in the project shall be utilize fiber optic cable and installed in dedicated conduits.
    - b. Contractor shall provide equipment, components, devices, hardware, patch panels and all appurtenances necessary to provide a fully operational system utilizing a UTP cabling topography. Coordinate all system cabling with system provider prior to shop drawing submission.
  2. In addition to all power requirements stipulated in specification section 28 05 00 and the related Chapters of this specification sections, all electrical power for remote system components shall be obtained from dedicated power supplies. All 120-Volt electrical power for any PACS components and\or devices shall be provided by this Contractor and supplied from the nearest appropriate emergency electrical distribution panels. System components employing the use of plug-in transformers for power shall not be acceptable.
    - 1) All system power supplies serving exterior system components or devices shall be provided with the appropriate transient surge and suppression protection on both the line side as well as the load side. Refer to specification section 28 05 00 for additional requirements.
  - B. Installation of all equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate trade contractors.
- 3.4 ELECTRICAL POWER DISTRIBUTION**
- A. Comply with all requirements of specification section 28 05 00.
- 3.5 TRANSIENT VOLTAGE SUPPRESSION**
- A. Comply with all requirements of specification section 28 05 00.
- 3.6 GROUNDING AND BONDING**
- A. Comply with all requirements of specification section 28 05 00.
- 3.7 EQUIPMENT IDENTIFICATION**
- A. Comply with all requirements of specification section 28 05 00.
- 3.8 MAINTENANCE & SERVICE**
- A. Comply with all requirements of specification section 28 05 00.
- 3.9 WARRANTY**
- A. Comply with all requirements of specification section 28 05 00.



### 3.10 Field Services

#### A. TESTING

1. In addition to all requirements as specified by Specification Section 28 05 00 the physical access control system shall also comply with the following requirements:
  - a. The completed access control system shall be fully tested in accordance with all requirements of NFPA 731. Upon completion of a successful testing, the contractor shall so certify in writing to the VA's Contracting Officer and Design Professional all was completed, tested, certified and left in first class operational condition, include all completed NFPA 731 certification and test reports.
  - b. The service of a competent, factory-trained engineer or technician authorized by the equipment manufacturer shall be provided to technically supervise installation and participate during initial system programming, start-up, final testing, assist in the final acceptance testing and Government Agency demonstrations.
  - c. At the minimum all acceptance testing, demonstrations and training shall include, but not be limited to the following:
    - 1) UPS Power and Secondary Power Distribution Capabilities
    - 2) Security Device Monitoring/Control Functions.
    - 3) Door Monitoring/Control Functions.
    - 4) HMI GUI map Integration and Functionality
    - 5) Automatic and Manual Threat Level Operations.
    - 6) Video Surveillance System Integration and Operations
    - 7) Video Surveillance Camera Alarm Call-up
    - 8) IDS and Emergency Call System Integration and Operations
    - 9) Third Party Database Import Functions.
    - 10) Remote System Access (LAN\WAN) Functions.
    - 11) All programming and operational functions and features as herein specified.
    - 12) Cable Supervision System (random points to be selected by the VA's Contracting Officer and Design Professional).
  - d. Demonstrate each system and subsystem. The demonstration shall include, but not be limited to the following:
    - 1) Designate actual location of each component of a system or subsystem and demonstrate its function and its relationship to other components within the system.
    - 2) Demonstrate the operation of all client servers, door interlock and bypass functions, camera call-up operations, graphic map functions, administration set-up, configurations and operations, badging functions and operations, emergency operations and system reboot procedures.
    - 3) Demonstrate all systems and subsystems operations by actual "LOCK/UNLOCK, ARM/DISARM" cycling showing how to work controls, how to reset devices, how to replace fuses and emergency operating/operations procedures.

- e. Upon final inspection a factory-trained and certified representative of the equipment manufacturer shall demonstrate to the VA's Contracting Officer and Design Professional that the system functions properly in every respect and is in full compliance with the contract documents. This requirement is in addition, to all testing requirements listed in specification section 28 05 00 and related specification sections.
- 1) Provide a minimum of (4) four 4-hour training classes performed at the project location and spaced over a two week interval. Training classes shall be scheduled not less than 48 hours apart to allow Government Agency operators to familiarize themselves with all system operations.
- 2) Include all training manuals, video instructions and hands-on demonstrations in the operation of all system components. Provide to the VA's Contracting Officer and Design Professional in advance lesson plans outlying training procedures, course outlines and objectives. Coordinate with VA's Contracting Officer and Design Professional in advance all training dates and schedules.

- - - END - - -

**SECTION 28 23 00  
VIDEO SURVEILLANCE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

PROVIDE AND INSTALL ADDITIONAL CAMERAS AND EQUIPMENT, WHICH IS IDENTIFIED AS THE CLOSED CIRCUIT TELEVISION SYSTEM HERE IN AFTER REFERRED TO AS THE CCTV SYSTEM AS SPECIFIED IN THIS SECTION.

**1.2 RELATED WORK**

- A. For general installation guidelines, Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.
- B. For Warranty of Construction, Section 01 00 00, GENERAL REQUIREMENTS.
- C. For General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

**1.3 SUBMITTALS**

- A. Submit below items in conjunction with Master Specification Sections 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES, and Section 02 41 00, DEMOLITION.
- B. Provide certificates of compliance with Section 1.3, Quality Assurance.
- C. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.
- D. Submit manufacturer's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):
  - 330-09.....Electrical Performance Standards for CCTV Cameras

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375A-76.....Electrical Performance Standards for CCTV  
Monitors

C. Institute of Electrical and Electronics Engineers (IEEE):

C62.41-02.....IEEE Recommended Practice on Surge Voltages in  
Low-Voltage AC Power Circuits

802.3af-08.....Power over Ethernet Standard

D. Federal Communications Commission (FCC):

(47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

E. National Electrical Contractors Association (NECA):

303-2005.....Installing Closed Circuit Television (CCTV)  
Systems

F. National Fire Protection Association (NFPA):

70-08.....Article 780-National Electrical Code

G. Federal Information Processing Standard (FIPS):

140-2-02.....Security Requirements for Cryptographic Modules

H. Underwriters Laboratories, Inc. (UL):

983-06.....Standard for Surveillance Camera Units

3044-01.....Standard for Surveillance Closed Circuit  
Television Equipment

## **1.5 WARRANTY OF CONSTRUCTION.**

Warrant CCTV System work subject to the Article "Warranty of  
Construction" of FAR clause 52.246-21.

## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT AND MATERIALS**

A. All Cameras will be EIA 330 and UL 983 compliant as well as:

1. Will be charge coupled device (CCD) cameras and shall conform to National Television System Committee (NTSC) formatting.
2. Shall be powered by 12V direct current or 24 VAC. Power supplies shall be Class 2 and UL compliant and have a back-up power source to ensure cameras are still operational in the event of loss of primary power to the CCTV System.
3. Will be home run or wireless networked to a monitoring and recording device via a controlling device such as a matrix switcher or network server and monitored on a 24 hour basis at existing designated Access Control System and Database Management location.

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4. Appropriate signage shall be designed, provided, and posted that notifies people that an area is under camera surveillance.
5. Dummy or fake cameras will not be utilized at any time.
6. Will be fitted with auto-iris lenses to ensure the image is maintained in low light.
7. If using the camera as part of a CCTV network a video encoder shall be used to convert the signal from National Television System(s) Committee (NTSC) to Moving Picture Experts Group (MPEG) format.
8. Cameras Technical Characteristics:

Effective Pixels	768 (H) x 494 (V)
Imaging Device	1/3" Interline Color CCD
Scanning System	2:1 Interlace
H. Resolution	540-line at color imaging
Signal-to-noise Ratio	>50dB (AGC off, weight on)
Minimum Illumination	0.3 lx
Gain Control	Auto/Manual(DIP switch)
Exposure	Auto (1/60-1/100,000)
White Balance	Auto/Manual (DIP switch), 2500K to 9500K
Backlight Compensation	On/Off (DIP switch)
Iris	Automatic (Open/Close is possible)/manual
Focus/Zoom	Manual
Focal Length	3.0 ~ 9.25 mm
Angular Field of View	H 30.2° ~ 95.0° V 22.6° ~ 69.0°
Iris Range	F1.0 ~ 1.7
Video Output	Composite - 1 Vp-p, 75 ohms UTP - 1 Vp-p, 100 ohms
Video Connector	BNC and UTP
Controller I/F	Multiplex-coaxial

- B. Lenses: Shall be utilized in a manner that provides maximum coverage of the area being monitored by the camera. The lenses shall:
1. Be 1/3" to fit CCD fixed camera.
  2. Be all glass with coated optics.
  3. Have mounts that are compatible with the camera selected.

4. Be packaged and supplied with the camera.
5. Have a maximum f-stop of f/1.3 for fixed lenses, and a maximum f-stop of f/1.6 for variable focus lenses.
6. Be equipped with an auto-iris mechanism.
7. Have sufficient circle of illumination to cover the image sensor evenly.
8. Not be used on a camera with an image format larger than the lens is designed to cover.
9. Be provided with pre-set capability.

C. Lenses shall be manual variable focus.

D. Camera Housings and Mounts:

1. This section pertains to all interior and exterior housings, domes, and applicable wall, ceiling, corner, pole, and rooftop mounts associated with the housing. Housings and mounts shall be specified in accordance to the type of cameras used.
2. All cameras and lenses shall be enclosed in a tamper resistant housing. Any additional mounting hardware required to install the camera housing at its specified location shall be provided along with the housing.
3. The camera and lens contained inside the housing shall be installed on a camera mount. All additional mounting hardware required to install the camera housing at its specified location shall be provided along with the housing.
4. Shall be manufactured in a manner that are capable of supporting a maximum of three (3) cameras with housings, and meet environmental requirements for the geographical area the camera support equipment is being installed on or within.

E. Wires and Cables

1. Shall meet or exceed the manufactures recommendation for power and signal.
2. Will be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinyl chloride (PVC) schedule 40 or 80.

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3. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will be contained in either EMT or RGS conduit.
4. All conduit, pull boxes, and junction boxes shall be clearly marked with colored permanent tape or paint that will allow it to be distinguished from all other conduit and infrastructure.
5. Conduit fills shall not exceed 50 percent unless otherwise documented.
6. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.
7. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area.
8. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security system shall be defined as any cable or sets of cables carrying 30 VDC/VAC or higher.
9. For all equipment that is carrying digital data between the Access Control System and Database Management or at a remote monitoring station, shall not be less than 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.
10. All cables and conductors, except fiber optic cables, that act as a control, communication, or signal lines shall include surge protection. Surge protection shall be furnished at the equipment end and additional triple electrode gas surge protectors rated for the application on each wire line circuit shall be installed within three (3) ft. (one (1) m.) of the building cable entrance. The inputs and outputs shall be tested in both normal and common mode using the following wave forms:
  - a. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and peak current of 60 amperes.

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- b. An 8 microsecond rise time by 20 microsecond pulse width wave form with a peak voltage of 1000 volts and peak current of 500 amperes.
- 11. The surge suppression device shall not attenuate or reduce the video or sync signal under normal conditions. Fuses and relays shall not be used as a means of surge protection.
- 12. Coaxial Cables
  - a. All video signal cables for the CCTV System shall be a coaxial cable and have a characteristic impedance of 75 ohms plus or minus 3 ohms.
  - b. For runs up to 750 feet use of an RG-59/U is required. The RG-59/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 23 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
  - c. For runs between 750 feet and 1250 feet, RG-6/U is required. RG-6/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 18 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
  - d. For runs of 1250 to 2750 feet, RG-11/U is required. RG-11/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 14 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
  - e. All runs greater than 2750 feet will be substituted with a fiber optic cable. If using fiber optics as a signal carrier then the following equipment will be utilized:
    - 1) Multimode fiber optic cable a minimum size of 62 microns
    - 2) Video transmitter, installed at the camera that utilizes 12 VDC or 24 VAC for power.
    - 3) Video receiver, installed at the switcher.



f. RG-59/U Technical Characteristics:

AWG	22
Stranding	7x29
Conductor Diameter	.031 in.
Conductor Material	BCC
Insulation Material	Gas-injected FHDPE
Insulation Diameter	.145 in.
Outer Shield Type	Braid/Braid
Outer Jacket Material	PVC
Overall Nominal Diameter	.242 in.
UL Temperature Rating	75°C
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.094 $\mu$ H/ft
Nom. Capacitance	Conductor to Shield 17.0 pF/ft
Nom. Velocity of Propagation	80 %
Nom. Delay	1.3 ns/ft
Nom. Conductor DC Resistance @ 20°C	12.2 Ohms/1000 ft
Nom. Outer Shield DC Resistance @ 20°C	2.4 Ohms/1000 ft
Max. Operating Voltage	UL 300 V RMS

g. RG-6/U Technical Characteristics:

AWG	18
Stranding	7x27
Conductor Diameter	.040 in.
Conductor Material	BC
Insulation Material	Gas-injected FHDPE
Insulation Diameter	.180 in.
Outer Shield Material	Trade Name Duofoil
Outer Shield Type	Tape/Braid
Outer Shield %Coverage	100 %
Outer Jacket Material	PVC
Overall Nominal Diameter	.274 in.
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.106 $\mu$ H/ft
Nom. Capacitance	Conductor to Shield 16.2 pF/ft
Nom. Velocity of Propagation	82 %
Nom. Delay	1.24 ns/ft
Nom. Conductor DC Resistance	6.4 Ohms/1000 ft
Nominal Outer Shield DC Resistance @ 20°C	2.8 Ohms/1000 ft
Max. Operating Voltage	UL 300 V RMS

h. RG-11/U Technical Characteristics:

AWG	15
Stranding	19x27
Conductor Diameter	.064 in.
Conductor Material	BC
Insulation Material	Gas-injected FHDPE
Insulation Diameter	.312 in.
Inner Shield Type	Braid
Inner Shield Material	BC - Bare Copper
Inner Shield %Coverage	95 %
Inner Jacket Material	PE - Polyethylene
Inner Jacket Diameter	.391 in.
Outer Shield Type	Braid
Outer Shield Material	BC - Bare Copper
Outer Shield %Coverage	95 %
Outer Jacket Material	Trade Name Belflex
Outer Jacket Material	PVC Blend
Overall Nominal Diameter	.520 in.
Operating Temperature Range	-35°C To +75°C
Non-UL Temperature Rating	75°C
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.097 $\mu$ H/ft
Nom. Capacitance	Conductor to Shield 17.3 pF/ft
Nom. Velocity of Propagation	78 %
Nom. Delay	1.30 ns/ft
Nom. Conductor DC Resistance	3.1 Ohms/1000 ft
Nom. Inner Shield DC Resistance	1.8 Ohms/1000 ft
Nom. Outer Shield DC Resistance	1.4 Ohms/1000 ft
Max. Operating Voltage Non-	300 V RMS

UL	
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13. Signal Cables:

- a. Signal wiring for PoE cameras depends on the distance the camera is being installed from either a hub or the server.
- b. If the camera is up to 300 ft from a hub or the server, then use a shielded UTP category 5 (CAT-V) cable with standard RJ-45 connector at each end. The cable must comply with the Power over Ethernet, IEEE802.3af, Standard.
- c. If the camera is over 300 ft from a hub or server then utilize a multimode fiber optic cable with a minimum size of 62 microns.
- d. Provide a separate cable for power.
- e. CAT-5 Technical Characteristics:

Number of Pairs	4
Total Number of Conductors	8
AWG	24
Stranding	Solid
Conductor Material	BC - Bare Copper
Insulation Material	PO - Polyolefin
Overall Nominal Diameter	.230 in.
IEC Specification	11801 Category 5
TIA/EIA Specification	568-B.2 Category 5e
Max. Capacitance Unbalance	(pF/100 m) 150 pF/100 m
Nom. Velocity of Propagation	70 %
Max. Delay	(ns/100 m) 538 @ 100MHz
Max. Delay Skew	(ns/100m) 45 ns/100 m
Max. Conductor DC Resistance	9.38 Ohms/100
Max. DCR Unbalance@ 20°C	3 %
Max. Operating Voltage	UL 300 V RMS

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. System installation shall be in accordance with NECA 303, manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.
- B. Components shall be configured with appropriate "service points" to pinpoint system trouble in less than 30 minutes.
- C. The Contractor shall install all system components including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, documentation listed in Sections 1.4 and 1.5 of this document, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
- D. The CCTV System will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a stand alone or a complete network.
- E. For integration purposes, the CCTV System shall be integrated where appropriate with the existing building 104 and 34 system.
- F. Integration with these security subsystems shall be achieved by computer programming or the direct hardwiring of the systems.
- G. For programming purposes refer to the manufacturers requirements for correct system operations. Ensure computers being utilized for system integration meet or exceed the minimum system requirements outlined on the systems software packages.
- H. The Contractor shall visit the site and verify that site conditions are in agreement/compliance with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Contracting Officer in the form of a report. The Contractor shall not take any corrective action without written permission received from the Contracting Officer.

I. Existing Equipment

1. The Contractor shall connect to and utilize existing video equipment, video and control signal transmission lines, and devices as outlined in the design package. Video equipment and signal lines that are usable in their original configuration without modification may be reused with Contracting Officer approval.
2. The Contractor shall perform a field survey, including testing and inspection of all existing video equipment and signal lines intended to be incorporated into the CCTV System, and furnish a report to the Contracting Officer as part of the site survey report. For those items considered nonfunctioning, provide (with the report) specification sheets, or written functional requirements to support the findings and the estimated cost to correct the deficiency. As part of the report, the Contractor shall include a schedule for connection to all existing equipment.
3. The Contractor shall make written requests and obtain approval prior to disconnecting any signal lines and equipment, and creating equipment downtime. Such work shall proceed only after receiving Contracting Officer approval of these requests. If any device fails after the Contractor has commenced work on that device, signal or control line, the Contractor shall diagnose the failure and perform any necessary corrections to the equipment.
4. The Contractor shall be held responsible for repair costs due to Contractor negligence, abuse, or incorrect installation of equipment.
5. The Contracting Officer shall be provided a full list of all equipment that is to be removed or replaced by the Contractor, to include description and serial/manufacturer numbers where possible. The Contractor shall dispose of all equipment that has been removed or replaced based upon approval of the Contracting Officer after reviewing the equipment removal list. In all areas where equipment is removed or replaced the Contractor shall repair those areas to match the current existing conditions.

- K. Enclosure Penetrations: All enclosure penetrations shall be from the bottom of the enclosure unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water and will comply with VA Master Specification 07 84 00, Firestopping. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer and in such a manner that the cable is not damaged.
- L. Cold Galvanizing: All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.
- M. Cameras:
1. Install the cameras with the focal length lens as indicated for each zone.
  2. Connect power and signal lines to the camera.
  3. Set cameras with fixed iris lenses to the f-stop to give full video level.
  4. Aim camera to give field of view as needed to cover the alarm zone.
  5. Aim fixed mounted cameras installed outdoors facing the rising or setting sun sufficiently below the horizon to preclude the camera looking directly at the sun.
  6. Focus the lens to give a sharp picture (to include checking for day and night focus and image quality) over the entire field of view; and synchronize all cameras so the picture does not roll on the monitor when cameras are selected. Dome cameras shall have all preset positions defined and installed.
- O. Camera Housings, Mounts, and Poles:
1. Install the camera housings and mounts as specified by the manufacturer and as shown, provide mounting hardware sized appropriately to secure each camera, housing and mount with maximum wind and ice loading encountered at the site.
  2. Provide a foundation for each camera pole as specified and shown.

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3. Provide a ground rod for each camera pole and connect the camera pole to the ground rod as specified in Division 26 of the VA Master Specification and the VA Electrical Manual 730.
4. Provide electrical and signal transmission cabling to the mount location via a hardened carrier system from the Access Control System and Database Management to the device.
5. Connect signal lines and AC power to the housing interfaces.
6. Connect pole wiring harness to camera.

T. System Start-Up

1. The Contractor shall not apply power to the CCTV System until the following items have been completed:
  - a. CCTV System equipment items and have been set up in accordance with manufacturer's instructions.
  - b. A visual inspection of the CCTV System has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
  - c. System wiring has been tested and verified as correctly connected as indicated.
  - d. All system grounding and transient protection systems have been verified as installed and connected as indicated.
  - e. Power supplies to be connected to the CCTV System have been verified as the correct voltage, phasing, and frequency as indicated.
2. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work efforts.

U. Supplemental Contractor Quality Control

1. The Contractor shall provide the services of technical representatives who are familiar with all components and installation procedures of the installed CCTV System; and are approved by the Contracting Officer.
2. The Contractor will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance.



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3. The Contractor shall also be available on an as needed basis to provide assistance with follow-up phases of quality control.
4. The Contractor shall participate in the testing and validation of the system and shall provide certification that the system installed is fully operational as all construction document requirements have been fulfilled.

### **3.2 TESTING AND TRAINING**

All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

- - - END - - -



**SECTION 28 31 00**  
**FIRE DETECTION AND ALARM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section of the specifications includes the furnishing, installation, and connection of the fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control units, fire safety control devices, annunciators, power supplies, and wiring as shown on the drawings and specified. Work scope shall expand upon the existing Simplex 4100 fire alarm system and may not be combined with other systems such as building automation, energy management, security, etc. The Wilkes-Barre VA Hospital Simplex contact is Mr. Joseph Kelly (570) 445-7509 or [jorskelly@simplexgrinnell.com](mailto:jorskelly@simplexgrinnell.com).
- B. Fire alarm systems shall comply with requirements of the most recent VA FIRE PROTECTION DESIGN MANUAL and NFPA 72 unless variations to NFPA 72 are specifically identified within these contract documents by the following notation: "variation". The design, system layout, document submittal preparation, and supervision of installation and testing shall be provided by a technician that is certified NICET level III or a registered fire protection engineer. The NICET certified technician shall be on site for the supervision and testing of the system. Factory engineers from the equipment manufacturer, thoroughly familiar and knowledgeable with all equipment utilized, shall provide additional technical support at the site as required by the COR or his authorized representative. Installers shall have a minimum of 2 years experience installing fire alarm systems.

C. Fire alarm signals:

1. Building shall have an automatic digitized voice fire alarm signal with emergency manual voice override to notify occupants to evacuate. The digitized voice message shall identify the area of the building (smoke zone) from which the alarm was initiated.
2. General evacuation fire alarm signal in accordance with ASA S3.41 to notify all occupants in the respective building to evacuate.

D. Alarm signals (by device), supervisory signals (by device) and system trouble signals (by device not reporting) shall be distinctly transmitted to the Simplex TrueSite Workstation.

E. The main fire alarm control unit shall automatically transmit alarm signals to a listed central station using a digital alarm communicator transmitter in accordance with NFPA 72.

**1.2 SCOPE**

A. An expansion of the addressable fire alarm system as an extension of an existing Simplex Brand addressable fire alarm system shall be designed and installed in accordance with the specifications and drawings. Device location and wiring runs shown on the drawings are for reference only unless specifically dimensioned. Actual locations shall be in accordance with NFPA 72 and this specification.

B. All existing fire alarm equipment, wiring, devices and sub-systems that are not shown to be reused shall be removed. All existing fire alarm conduit not reused shall be removed.

C. Existing fire alarm bells, chimes, door holders, 120VAC duct smoke detectors, valve tamper switches and waterflow/pressure switches may be reused only as specifically indicated on the drawings and provided the equipment:

1. Meets this specification section
2. Is UL listed or FM approved
3. Is compatible with new equipment being installed
4. Is verified as operable through contractor testing and inspection
5. Is warranted as new by the contractor.

D. Existing 120 VAC duct smoke detectors, waterflow/pressure switches, and valve tamper switches reused by the Contractor shall be equipped with an addressable interface device compatible with the new equipment being installed.

E. Existing reused equipment shall be covered as new equipment under the Warranty specified herein.

F. Basic Performance:

1. Alarm and trouble signals from each building fire alarm control panel shall be digitally encoded by UL listed electronic devices onto a multiplexed communication system.
2. Response time between alarm initiation (contact closure) and recording at the main fire alarm control unit (appearance on alphanumeric read out) shall not exceed 5 seconds.
3. The signaling line circuits (SLC) between building fire alarm control units shall be wired Style 7 in accordance with NFPA 72. Isolation shall be provided so that no more than one building can be lost due to a short circuit fault.
4. Initiating device circuits (IDC) shall be wired Style C in accordance with NFPA 72.
5. Signaling line circuits (SLC) within buildings shall be wired Style 4 in accordance with NFPA 72. Individual signaling line circuits shall be limited to covering 22,500 square feet (2,090 square meters) of floor space or 3 floors whichever is less.
6. Notification appliance circuits (NAC) shall be wired Style Y in accordance with NFPA 72.

### **1.3 RELATED WORK**

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES. Requirements for procedures for submittals.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for fire proofing wall penetrations.
- C. Section 08 71 00 - DOOR HARDWARE. For combination Closer-Holders.
- D. Section 21 13 13 - WET-PIPE SPRINKLER SYSTEMS. Requirements for sprinkler systems.
- E. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.
- F. Section 28 08 00, COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning - systems readiness checklists, and training.
- G. Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS (PACS). Requirements for integration with physical access control system.

#### 1.4 SUBMITTALS

- A. General: Submit 5 copies in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Drawings:
1. Prepare drawings using the most current version of AutoCAD compatible with the local VA license and include all contractors' information. Layering shall be by VA criteria as provided by the Contracting Officer's Technical Representative (COR). Bid drawing files on AutoCAD will be provided to the Contractor at the pre-construction meeting. The contractor shall be responsible for verifying all critical dimensions shown on the drawings provided by VA.
  2. Floor plans: Provide locations of all devices (with device number at each addressable device corresponding to control unit programming), appliances, panels, equipment, junction/terminal cabinets/boxes, risers, electrical power connections, individual circuits and raceway routing, system zoning; number, size, and type of raceways and conductors in each raceway; conduit fill calculations with cross section area percent fill for each type and size of conductor and raceway. Only those devices connected and incorporated into the final system shall be on these floor plans. Do not show any removed devices on the floor plans. Show all interfaces for all fire safety functions.
  3. Riser diagrams: Provide, for the entire system, the number, size and type of riser raceways and conductors in each riser raceway and number of each type device per floor and zone. Show door holder interface, elevator control interface, HVAC shutdown interface, fire extinguishing system interface, and all other fire safety interfaces. Show wiring Schedules on the riser diagram for all circuits. Provide diagrams both on a per building and campus wide basis.

4. Detailed wiring diagrams: Provide for control panels, modules, power supplies, electrical power connections, auxiliary relays and annunciators showing termination identifications, size and type conductors, circuit boards, LED lamps, indicators, adjustable controls, switches, ribbon connectors, wiring harnesses, terminal strips and connectors, spare zones/circuits. Diagrams shall be drawn to a scale sufficient to show spatial relationships between components, enclosures and equipment configuration.
5. Two weeks prior to final inspection, the Contractor shall deliver to the COR 3 sets of as-built drawings and one set of the as-built drawing computer files in AutoCAD DWG format. As-built drawings (floor plans) shall show all new and/or existing conduit used for the fire alarm system.

C. Manuals:

1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets for all items used in the system, power requirements, device wiring diagrams, dimensions, and information for ordering replacement parts.
  - a. Wiring diagrams shall have their terminals identified to facilitate installation, operation, expansion and maintenance.
  - b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
  - c. Include complete listing of all software used and installation and operation instructions including the input/output matrix chart.
  - d. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate, inspect, test and maintain the equipment and system. Provide all manufacturer's installation limitations including but not limited to circuit length limitations.
  - e. Complete listing of all digitized voice messages.
  - f. Provide standby battery calculations under normal operating and alarm modes. Battery calculations shall include the magnets for holding the doors open for one minute.

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- g. Include information indicating who will provide emergency service and perform post contract maintenance.
  - h. Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.
  - i. A computerized preventive maintenance schedule for all equipment. The schedule shall be provided on disk in a computer format acceptable to the VAMC and shall describe the protocol for preventive maintenance of all equipment. The schedule shall include the required times for systematic examination, adjustment and cleaning of all equipment. A print out of the schedule shall also be provided in the manual. Provide the disk in a pocket within the manual.
  - j. Furnish manuals in 3 ring loose-leaf binder or manufacturer's standard binder.
  - k. A print out for all devices proposed on each signaling line circuit with spare capacity indicated.
2. Two weeks prior to final inspection, deliver 4 copies of the final updated maintenance and operating manual to the COR.
- a. The manual shall be updated to include any information necessitated by the maintenance and operating manual approval.
  - b. Complete "As installed" wiring and schematic diagrams shall be included that shows all items of equipment and their interconnecting wiring. Show all final terminal identifications.
  - c. Complete listing of all programming information, including all control events per device including an updated input/output matrix.
  - d. Certificate of Installation as required by NFPA 72 for each building. The certificate shall identify any variations from the National Fire Alarm Code.
  - e. Certificate from equipment manufacturer assuring compliance with all manufacturers installation requirements and satisfactory system operation.



D. Certifications:

1. Together with the shop drawing submittal, submit the technician's NICET level III fire alarm certification as well as certification from the control unit manufacturer that the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include in the certification the names and addresses of the proposed supervisor of installation and the proposed performer of contract maintenance. Also include the name and title of the manufacturer's representative who makes the certification.
2. Together with the shop drawing submittal, submit a certification from either the control unit manufacturer or the manufacturer of each component (e.g., smoke detector) that the components being furnished are compatible with the control unit.
3. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer that the wiring and connection diagrams meet this specification, UL and NFPA 72 requirements.

**1.5 WARRANTY**

- A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer.

**1.6 GUARANTY PERIOD SERVICES**

- A. Complete inspection, testing, maintenance and repair service for the fire alarm system shall be provided by a factory trained authorized representative of the manufacturer of the major equipment for a period of 5 years from the date of acceptance of the entire installation by the Contracting Officer.
- B. Contractor shall provide all necessary test equipment, parts and labor to perform required inspection, testing, maintenance and repair.
- C. All inspection, testing, maintenance and permanent records required by NFPA 72, and recommended by the equipment manufacturer shall be provided by the contractor. Work shall include operation of sprinkler system alarm and supervisory devices as well as all reused existing equipment connected to the fire alarm system. It shall include all interfaced equipment including but not limited to elevators, HVAC shutdown, and extinguishing systems.

- D. Maintenance and testing shall be performed in accordance with NFPA 72. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment and cleaning of all equipment.
- E. Non-included Work: Repair service shall not include the performance of any work due to improper use, accidents, or negligence for which the contractor is not responsible.
- F. Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of the work performed and parts replaced shall be provided to the VA COR or his authorized representative.
- G. Emergency Service:
1. Warranty Period Service: Service other than the preventative maintenance, inspection, and testing required by NFPA 72 shall be considered emergency call-back service and covered under the warranty of the installation during the first year of the warranty period, unless the required service is a result of abuse or misuse by the Government. Written notification shall not be required for emergency warranty period service and the contractor shall respond as outlined in the following sections on Normal and Overtime Emergency Call-Back Service. Warranty period service can be required during normal or overtime emergency call-back service time periods at the discretion of the COR or his authorized representative.
  2. Normal and overtime emergency call-back service shall consist of an on-site response within 2 hours of notification of a system trouble.
  3. Normal emergency call-back service times are between the hours of 7:30 a.m. and 4:00 p.m., Monday through Friday, exclusive of federal holidays. Service performed during all other times shall be considered to be overtime emergency call-back service. The cost of all normal emergency call-back service for years 2 through 5 shall be included in the cost of this contract.

4. Overtime emergency call-back service shall be provided for the system when requested by the Government. The cost of the first 40 manhours per year of overtime call-back service during years 2 through 5 of this contract shall be provided under this contract. Payment for overtime emergency call-back service in excess of the 40 man hours per year requirement will be handled through separate purchase orders. The method of calculating overtime emergency call-back hours is based on actual time spent on site and does not include travel time.
- H. The contractor shall maintain a log at each fire alarm control unit. The log shall list the date and time of all examinations and trouble calls, condition of the system, and name of the technician. Each trouble call shall be fully described, including the nature of the trouble, necessary correction performed, and parts replaced.
- I. In the event that VA modifies the fire alarm system post-Acceptance but during the 5 year Guaranty Period Service period, Contractor shall be required to verify that the system, as newly modified or added, is consistent with the manufacturer's requirements; any verification performed will be equitably adjusted under the Changes clause. The post-Acceptance modification or addition to the fire alarm system shall not void the continuing requirements under this contract set forth in the Guarantee Period Service provision for the fire alarm system as modified or added. The contract will be equitably adjusted under the Changes clause for such additional performance.

#### **1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only and the latest editions of these publications shall be applicable.
- B. National Fire Protection Association (NFPA):
- NFPA 13 .....Standard for the Installation of Sprinkler  
Systems, 2010 edition
- NFPA 14 .....Standard for the Installation of Standpipes and  
Hose Systems, 2010 edition
- NFPA 20 .....Standard for the Installation of Stationary  
Pumps for Fire Protection, 2010 edition

- NFPA 70.....National Electrical Code (NEC), 2010 edition  
NFPA 72.....National Fire Alarm Code, 2010 edition  
NFPA 90A.....Standard for the Installation of Air  
Conditioning and Ventilating Systems, 2009  
edition  
NFPA 101.....Life Safety Code, 2009 edition  
C. Underwriters Laboratories, Inc. (UL): Fire Protection Equipment  
Directory  
D. Factory Mutual Research Corp (FM): Approval Guide, 2007-2011  
E. American National Standards Institute (ANSI):  
S3.41.....Audible Emergency Evacuation Signal, 1990  
edition, reaffirmed 2008  
F. International Code Council, International Building Code (IBC), 2009  
edition

## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT AND MATERIALS, GENERAL**

- A. All equipment and components shall be new and the manufacturer's current model. All equipment shall be tested and listed by Underwriters Laboratories, Inc. or Factory Mutual Research Corporation for use as part of a fire alarm system. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturers' requirements and that satisfactory total system operation has been achieved.

### **2.2 CONDUIT, BOXES, AND WIRE**

- A. Conduit shall be in accordance with Section 28 05 28.33 CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY and as follows:
1. All new conduits shall be installed in accordance with NFPA 70.
  2. Conduit fill shall not exceed 40 percent of interior cross sectional area.
  3. All new conduits shall be 3/4 inch (19 mm) minimum.

B. Wire:

1. Wiring shall be in accordance with NEC article 760, Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY, and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.
2. Addressable circuits and wiring used for the multiplex communication loop shall be twisted and shielded unless specifically excepted by the fire alarm equipment manufacturer in writing.
3. Any fire alarm system wiring that extends outside of a building shall have additional power surge protection to protect equipment from physical damage and false signals due to lightning, voltage and current induced transients. Protection devices shall be shown on the submittal drawings and shall be UL listed or in accordance with written manufacturer's requirements.
4. All wire or cable used in underground conduits including those in concrete shall be listed for wet locations.

C. Terminal Boxes, Junction Boxes, and Cabinets:

1. Shall be galvanized steel in accordance with UL requirements.
2. All boxes shall be sized and installed in accordance with NFPA 70.
3. covers shall be repainted red in accordance with Section 09 91 00, PAINTING and shall be identified with white markings as "FA" for junction boxes and as "FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of 3/4 inch (19 mm) high.
4. Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.
5. Terminal boxes and cabinets shall have identified pressure type terminal strips and shall be located at the base of each riser. Terminal strips shall be labeled as specified or as approved by the COR.

## **2.3 FIRE ALARM CONTROL UNIT**

### **A. General:**

1. Each building expansion shall be provided with a fire alarm control unit and shall operate as a supervised zoned fire alarm system.
2. Each power source shall be supervised from the other source for loss of power.
3. All circuits shall be monitored for integrity.
4. Visually and audibly annunciate any trouble condition including, but not limited to main power failure, grounds and system wiring derangement.
5. Transmit digital alarm information to the main fire alarm control unit.

### **B. Enclosure:**

1. The control unit shall be housed in a cabinet suitable for both recessed and surface mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. Cabinet shall contain all necessary relays, terminals, lamps, and legend plates to provide control for the system.

### **C. Operator terminal at main control unit:**

1. Shall be those as specified by SimplexGrinnell appropriate to the specific project needs.

### **D. Power Supply:**

1. The control unit shall derive its normal power from a 120 volt, 60 Hz dedicated supply connected to the emergency power system. Standby power shall be provided by a 24 volt DC battery as hereinafter specified. The normal power shall be transformed, rectified, coordinated, and interfaced with the standby battery and charger.
2. The door holder power shall be arranged so that momentary or sustained loss of main operating power shall not cause the release of any door.
3. Power supply for smoke detectors shall be taken from the fire alarm control unit.
4. Provide protectors to protect the fire alarm equipment from damage due to lightning or voltage and current transients.
5. Provide new separate and direct ground lines to the outside to protect the equipment from unwanted grounds.

- E. Circuit Supervision: Each alarm initiating device circuit, signaling line circuit, and notification appliance circuit, shall be supervised against the occurrence of a break or ground fault condition in the field wiring. These conditions shall cause a trouble signal to sound in the control unit until manually silenced by an off switch.
- F. Supervisory Devices: All sprinkler system valves, standpipe control valves, post indicator valves (PIV), and main gate valves shall be supervised for off-normal position. Closing a valve shall sound a supervisory signal at the control unit until silenced by an off switch. The specific location of all closed valves shall be identified at the control unit. Valve operation shall not cause an alarm signal. Low air pressure switches and duct detectors shall be monitored as supervisory signals. The power supply to the elevator shunt trip breaker shall be monitored by the fire alarm system as a supervisory signal.
- G. Trouble signals:
  - 1. Arrange the trouble signals for automatic reset (non-latching).
  - 2. System trouble switch off and on lamps shall be visible through the control unit door.
- H. Function Switches: Provide the following switches in addition to any other switches required for the system:
  - 1. Remote Alarm Transmission By-pass Switch: Shall prevent transmission of all signals to the main fire alarm control unit when in the "off" position. A system trouble signal shall be energized when switch is in the off position.
  - 2. Alarm Off Switch: Shall disconnect power to alarm notification circuits on the local building alarm system. A system trouble signal shall be activated when switch is in the off position.
  - 3. Trouble Silence Switch: Shall silence the trouble signal whenever the trouble silence switch is operated. This switch shall not reset the trouble signal.
  - 4. Reset Switch: Shall reset the system after an alarm, provided the initiating device has been reset. The system shall lock in alarm until reset.
  - 5. Lamp Test Switch: A test switch or other approved convenient means shall be provided to test the indicator lamps.

6. Drill Switch: Shall activate all notification devices without tripping the remote alarm transmitter. This switch is required only for general evacuation systems specified herein.
7. Door Holder By-Pass Switch: Shall prevent doors from releasing during fire alarm tests. A system trouble alarm shall be energized when switch is in the abnormal position.
8. Elevator recall By-Pass Switch: Shall prevent the elevators from recalling upon operation of any of the devices installed to perform that function. A system trouble alarm shall be energized when the switch is in the abnormal position.
9. HVAC/Smoke Damper By-Pass: Provide a means to disable HVAC fans from shutting down and/or smoke dampers from closing upon operation of an initiating device designed to interconnect with these devices.
- I. Remote Transmissions:
  1. Provide capability and equipment for transmission of alarm, supervisory and trouble signals to the main fire alarm control unit.
  2. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.
- J. Remote Control Capability: Each building fire alarm control unit shall be installed and programmed so that each must be reset locally after an alarm, before the main fire alarm control unit can be reset. After the local building fire alarm control unit has been reset, then the all system acknowledge, reset, silence or disabling functions can be operated by the main fire alarm control unit
- K. System Expansion: Design the control units and enclosures so that the system can be expanded in the future (to include the addition of 20 percent more alarm initiating, alarm notification and door holder circuits) without disruption or replacement of the existing control unit and secondary power supply.



## **2.4 STANDBY POWER SUPPLY**

### **A. Uninterrupted Power Supply (UPS):**

1. The UPS system shall be comprised of a static inverter, a precision battery float charger, and sealed maintenance free batteries.
2. Under normal operating conditions, the load shall be filtered through a ferroresonant transformer.
3. When normal AC power fails, the inverter shall supply AC power to the transformer from the battery source. There shall be no break in output of the system during transfer of the system from normal to battery supply or back to normal.
4. Batteries shall be sealed, gel cell type.
5. UPS system shall be sized to operate the central processor, CRT, printer, and all other directly connected equipment for 5 minutes upon a normal AC power failure.

### **B. Batteries:**

1. Battery shall be of the sealed, maintenance free type, 24-volt nominal.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 5 minutes of alarm to an end voltage of 1.14 volts per cell, upon a normal AC power failure.
3. Battery racks shall be steel with an alkali-resistant finish. Batteries shall be secured in seismic areas 2B, 3, or 4 as defined by the Uniform Building Code.

### **C. Battery Charger:**

1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120-volt, 60 hertz emergency power source.
2. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
3. Shall have protection to prevent discharge through the charger.
4. Shall have protection for overloads and short circuits on both AC and DC sides.
5. A trouble condition shall actuate the fire alarm trouble signal.
6. Charger shall have automatic AC line voltage regulation, automatic current-limiting features, and adjustable voltage controls.

## 2.5 ANNUNCIATION

### A. Annunciator (System):

1. Shall be a supervised, LCD display containing a minimum of 2 lines of 40 characters for alarm annunciation in clear English text.
2. Annunciators shall display information for all buildings connected to the system. Local building annunciators, for general evacuation system buildings, shall be permitted when shown on the drawings and approved by the COR.

### B. Printers:

1. System printers shall be high reliability digital input devices, UL approved, for fire alarm applications. The printers shall operate at a minimum speed of 30 characters per second. The printer shall be continually supervised.
2. Printers shall be programmable to either alarm only or event logging output.
  - a. Alarm printers shall provide a permanent (printed) record of all alarm information that occurs within the fire alarm system. Alarm information shall include the date, time, building number, floor, zone, device type, device address, and condition.
  - b. Event logging printers shall provide a permanent (printed) record of every change of status that occurs within the fire alarm system. Status information shall include date, time, building number, floor, zone, device type, device address and change of status (alarm, trouble, supervisory, reset/return to normal).
3. System printers shall provide tractor drive feed pins for conventional fan fold 8-1/2" x 11" (213 mm x 275 mm) paper.
4. The printers shall provide a printing and non-printing self test feature.
5. Power supply for printers shall be taken from and coordinated with the building emergency service.
6. Each printer shall be provided with a stand for the printer and paper.
7. Spare paper and ribbons for printers shall be stocked and maintained as part of the one year guarantee period services in addition to the one installed after the approval of the final acceptance test.

## **2.6 VOICE COMMUNICATION SYSTEM (VCS)**

### **A. General:**

1. An emergency voice communication system shall be installed throughout Wilkes-Barre VA Complex.
2. Upon receipt of an alarm signal from the building fire alarm system, the VCS shall automatically transmit a pre-recorded fire alarm message as appropriate to the area based on current system programming.
3. A digitized voice module shall be used to store each prerecorded message.
4. The VCS shall be arranged to maintain the existing channel arrangement.
5. The VCS shall supervise all speaker circuits, control equipment, remote audio control equipment, and amplifiers.

### **B. Speaker Circuit Control Unit:**

1. The speaker circuit control unit shall include switches to manually activate or deactivate speaker circuits grouped by floor in the system.
2. Speaker circuit control switches shall provide on, off, and automatic positions and indications.
3. The speaker circuit control unit shall include visual indication of active or trouble status for each group of speaker circuits in the system.
4. A trouble indication shall be provided if a speaker circuit group is disabled.
5. A lamp test switch shall be provided to test all indicator lamps.
6. A single "all call" switch shall be provided to activate all speaker circuit groups simultaneously.
7. A push-to-talk microphone shall be provided for manual voice messages.
8. Remote microphones shall be provided in the accordance with project documents.
9. A voice message disconnect switch shall be provided to disconnect automatic digitized voice messages from the system. The system shall be arranged to allow manual voice messages and indicate a system trouble condition when activated.

C. Speaker Circuit Arrangement:

1. Speaker circuits shall be arranged such that there is one speaker circuit per smoke zone.
2. Audio amplifiers and control equipment shall be electrically supervised for normal and abnormal conditions.
3. Speaker circuits shall be either 25 VRMS or 70.7 VRMS with a minimum of 50 percent spare power available.
4. Speaker circuits and control equipment shall be arranged such that loss of any one speaker circuit will not cause the loss of any other speaker circuit in the system.

D. Digitized Voice Module (DVM):

1. The Digitized Voice Module shall provide prerecorded digitized evacuation and instructional messages. The messages shall be professionally recorded and approved by the COR prior to programming.
2. The DVM shall be configured to automatically output to the desired circuits following a 10-second slow whoop alert tone.
3. Prerecorded magnetic taped messages and tape players are not permitted.
4. The digitized message capacity shall be no less than 15 second in length.
5. The digitized message shall be transmitted 3 times.
6. The DVM shall be supervised for operational status.
7. Failure of the DVM shall result in the transmission of a constant alarm tone.
8. The DVM memory shall have a minimum 50 percent spare capacity after those messages identified in this section are recorded. Multiple DVM's may be used to obtain the required capacity.

E. Audio Amplifiers:

1. Audio Amplifiers shall provide a minimum of 50 Watts at either 25 or 70.7 VRMS output voltage levels.
2. Amplifiers shall be continuously supervised for operational status.
3. Amplifiers shall be configured for either single or dual channel application.
4. Each audio output circuit connection shall be configurable for Style X.

5. A minimum of 50 percent spare output capacity shall be available for each amplifier.

F. Tone Generator(s):

1. Tone Generator(s) shall be capable of providing a distinctive 3-pulse temporal pattern fire alarm signal as well as a slow whoop.
2. Tone Generator(s) shall be continuously supervised for operational status.

## **2.7 ALARM NOTIFICATION APPLIANCES**

A. Speakers:

1. Shall operate on either 25 VRMS or 70.7 VRMS with field selectable output taps from 0.5 to 2.0W and originally installed at the 1/2 watt tap. Speakers shall provide a minimum sound output of 80 dBA at 10 feet (3,000 mm) with the 1/2 watt tap.
2. Frequency response shall be a minimum of 400 HZ to 4,000 HZ.
3. Four inches (100 mm) or 8 inches (200 mm) cone type speakers ceiling mounted with white colored baffles in areas with suspended ceilings and wall mounted in areas without ceilings.

B. Strobes:

1. Xenon flash tube type minimum 15 candela in toilet rooms and 30,75, 110 candela sized to all other areas with a flash rate of 1 HZ. Strobes shall be synchronized where required by the National Fire Alarm Code (NFPA 72).
2. Backplate shall be red with 1/2 inch (13 mm) permanent red letters. Lettering to read "Fire", be oriented on the wall or ceiling properly, and be visible from all viewing directions.
3. Each strobe circuit shall have a minimum of 20 percent spare capacity.
4. Strobes may be combined with the audible notification appliances specified herein.

## **2.8 ALARM-INITIATING DEVICES**

### **A. Manual Fire Alarm Stations:**

1. Shall be non-break glass, address reporting type.
2. Station front shall be constructed of a durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.
3. Stations shall be of single action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE."
4. Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until reset. A key shall be required to gain front access for resetting, or conducting tests and drills.
5. Unless otherwise specified, all exposed parts shall be red in color and have a smooth, hard, durable finish.

### **B. Smoke Detectors:**

1. Smoke detectors shall be photoelectric type and UL listed for use with the fire alarm control unit being furnished.
2. Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.
3. Detectors shall have an indication lamp to denote an alarm condition. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
4. All spot type and duct type detectors installed shall be of the photoelectric type.
5. Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot.

6. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.

C. Heat Detectors:

1. Heat detectors shall be of the addressable restorable rate compensated fixed-temperature spot type.
2. Detectors shall have a minimum smooth ceiling rating of 2,500 square feet (230 square meters).
3. Ordinary temperature (135 degrees F (57 degrees C)) heat detectors shall be utilized in elevator shafts and elevator mechanical rooms. Intermediate temperature rated (200 degrees F (93 degrees C)) heat detectors shall be utilized in all other areas.
4. Provide a remote indicator lamp, key test station and identification nameplate (e.g. "Heat Detector - Elevator P-\_\_\_\_\_ ) for each elevator group. Locate key test station in plain view on elevator machine room wall.

D. Water Flow and Pressure Switches:

1. Wet pipe water flow switches and dry pipe alarm pressure switches for sprinkler systems shall be connected to the fire alarm system by way of an address reporting interface device.
2. All new water flow switches shall be of a single manufacturer and series and non-accumulative retard type.
3. All new switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Timing shall be recorded and documented during testing.

## 2.9 SUPERVISORY DEVICES

### A. Duct Smoke Detectors:

1. Duct smoke detectors shall be provided and connected by way of an address reporting interface device. Detectors shall be provided with an approved duct housing mounted exterior to the duct, and shall have perforated sampling tubes extending across the full width of the duct (wall to wall). Detector placement shall be such that there is uniform airflow in the cross section of the duct.
2. Interlocking with fans shall be provided in accordance with NFPA 90A and as specified hereinafter under Part 3.2, "TYPICAL OPERATION".
3. Provide remote indicator lamps, key test stations and identification nameplates (e.g. "DUCT SMOKE DETECTOR AHU-X") for all duct detectors. Locate key test stations in plain view on walls or ceilings so that they can be observed and operated from a normal standing position.

### B. Sprinkler and Standpipe System Supervisory Switches:

1. Each sprinkler system water supply control valve, riser valve or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valve shall be equipped with a supervisory switch.
3. Valve supervisory switches shall be connected to the fire alarm system by way of address reporting interface device. See Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS for new switches to be added. Connect tamper switches for all control valves shown on the approved shop drawings.
4. The mechanism shall be contained in a weatherproof die-cast aluminum housing that shall provide a 3/4 inch (19 mm) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The entire installed assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.



6. Where dry-pipe sprinkler systems are installed, high and low air pressure switches shall be provided and monitored by way of an address reporting interface devices.
7. Fire supervisory signals required by NFPA 20 and monitored by the pump controller shall be provided and monitored by way of address reporting interface devices for the fire pump.

#### **2.10 ADDRESS REPORTING INTERFACE DEVICE**

- A. Shall have unique addresses that reports directly to the building fire alarm panel.
- B. Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.
- C. Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.
- D. Shall be UL listed for fire alarm use and compatibility with the panel to which they are connected.
- E. Shall be mounted in weatherproof housings if mounted exterior to a building.

#### **2.11 SMOKE BARRIER DOOR CONTROL**

- A. Electromagnetic Door Holders:
  1. New Door Holders shall be standard wall mounted electromagnetic type. In locations where doors do not come in contact with the wall when in the full open position, an extension post shall be added to the door bracket.
  2. Operation shall be by 24 volt DC supplied from a battery located at the fire alarm control unit. Door holders shall be coordinated as to voltage, ampere drain, and voltage drop with the battery, battery charger, wiring and fire alarm system for operation as specified.
- B. A maximum of twelve door holders shall be provided for each circuit. Door holders shall be wired to allow releasing doors by smoke zone.
- C. Door holder control circuits shall be electrically supervised.
- D. Smoke detectors shall not be incorporated as an integral part of door holders.

**2.12 UTILITY LOCKS AND KEYS:**

- A. All key operated test switches, control units, annunciator panels and lockable cabinets shall be provided with a single standardized utility lock and key.
- B. Key-operated manual fire alarm stations shall have a single standardized lock and key separate from the control equipment.
- C. All keys shall be delivered to the COR.

**2.13 SPARE AND REPLACEMENT PARTS**

- A. Provide spare and replacement parts equal to one percent of the total of each device type required for the work area, not less than one of each type.
- B. Spare and replacement parts shall be in original packaging and submitted to the COR.
- C. Furnish and install a storage cabinet of sufficient size and suitable for storing spare equipment. Doors shall include a pad locking device. Padlock to be provided by the VA. Location of cabinet to be determined by the COR.
- D. Provide to the VA, all hardware, software, programming tools, license and documentation necessary to permanently modify the fire alarm system on site. The minimum level of modification includes addition and deletion of devices, circuits, zones and changes to system description, system operation, and digitized evacuation and instructional messages.

**2.14 INSTRUCTION CHART:**

Provide typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame with a backplate. Install the frame in a conspicuous location observable from each control unit where operations are performed. The card shall show those steps to be taken by an operator when a signal is received under all conditions, normal, alarm, supervisory, and trouble. Provide an additional copy with the binder for the input output matrix for the sequence of operation. The instructions shall be approved by the COR before being posted.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Installation shall be in accordance with NFPA 70, 72, 90A, and 101 as shown on the drawings, and as recommended by the major equipment manufacturer. Fire alarm wiring shall be installed in conduit. All conduit and wire shall be installed in accordance with, Section 28 05 13 CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY, Section 28 05 26 GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY, Section 28 05 28.33 CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY, and all penetrations of smoke and fire barriers shall be protected as required by Section 07 84 00, FIRESTOPPING.
- B. All conduits, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.
- C. All new and reused exposed conduits shall be painted in accordance with Section 09 91 00, PAINTING to match surrounding finished areas and red in unfinished areas.
- D. All existing accessible fire alarm conduit not reused shall be removed.
- E. Existing devices that are reused shall be properly mounted and installed. Where devices are installed on existing shallow backboxes, extension rings of the same material, color and texture of the new fire alarm devices shall be used. Mounting surfaces shall be cut and patched in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Restoration, and be re-painted in accordance with Section 09 91 00, PAINTING as necessary to match existing.
- F. All fire detection and alarm system devices, control units and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Exact locations are to be approved by the COR.
- G. Speakers shall be ceiling mounted and fully recessed in areas with suspended ceilings. Speakers shall be wall mounted and recessed in finished areas without suspended ceilings. Speakers may be surface mounted in unfinished areas.
- H. Strobes shall be flush wall mounted with the bottom of the unit located 80 inches (2,000 mm) above the floor or 6 inches (150 mm) below ceiling, whichever is lower. Locate and mount to maintain a minimum 36 inches (900 mm) clearance from side obstructions.

- I. Manual pull stations shall be installed not less than 42 inches (1,050 mm) or more than 48 inches (1,200 mm) from finished floor to bottom of device and within 60 inches (1,500 mm) of a stairway or an exit door.
- J. Where possible, locate water flow and pressure switches a minimum of 12 inches (300 mm) from a fitting that changes the direction of the flow and a minimum of 36 inches (900 mm) from a valve.
- K. Mount valve tamper switches so as not to interfere with the normal operation of the valve and adjust to operate within 2 revolutions toward the closed position of the valve control, or when the stem has moved no more than 1/5 of the distance from its normal position.
- L. Connect flow and tamper switches installed under Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS.
- M. Connect combination closer-holders installed under Section 08 71 00, DOOR HARDWARE.

### **3.2 TYPICAL OPERATION**

- A. Activation of any manual pull station, water flow or pressure switch, heat detector, kitchen hood suppression system, gaseous suppression system, or smoke detector shall cause the following operations to occur:
  - 1. Operate the emergency voice communication system sounding a temporal pattern and flash strobes in accordance with the facilities emergency notification plan.
  - 2. Release only the magnetic door holders in the smoke zone on the floor from which alarm was initiated.
  - 3. Transmit a separate alarm signal, via the main fire alarm control unit to the fire department.
  - 4. Unlock the electrically locked exit doors within the zone of alarm.
- B. Heat detectors in elevator machine rooms shall, in addition to the above functions, disconnect all power to all elevators served by that machine room after a time delay. The time delay shall be programmed within the fire alarm system programming and be equal to the time it takes for the car to travel from the highest to the lowest level, plus 10 seconds.
- C. Smoke detectors in the primary elevator lobbies shall, in addition to the above functions, return all elevators in the bank to the secondary floor.

- D. Smoke detectors in the remaining elevator lobbies, elevator machine room, or top of hoistway shall, in addition to the above functions, return all elevators in the bank to the primary floor.
- E. Operation of a smoke detector at a corridor door used for automatic closing shall also release only the magnetic door holders on that floor in that smoke zone. Operation of a smoke detector at a shutter used for automatic closing shall also release only the shutters on that floor in that smoke zone.
- F. Operation of duct smoke detectors shall cause a system supervisory condition and shut down the ventilation system and close the associated smoke dampers as appropriate.
- G. Operation of any sprinkler or standpipe system valve supervisory switch, high/low air pressure switch, or fire pump alarm switch shall cause a system supervisory condition.
- H. Alarm verification shall not be used for smoke detectors installed for the purpose of early warning.

### **3.3 TESTS**

- A. Provide the service of a NICET level III, competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the COR.
- B. When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests in the presence of the COR. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meets all contract requirements. After the system has passed the initial test and been approved by the COR, the contractor may request a final inspection.
  - 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
  - 2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
  - 3. Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.

4. Open each alarm initiating and notification circuit to see if trouble signal actuates.
5. Ground each alarm initiation and notification circuit and verify response of trouble signals.

### **3.4 FINAL INSPECTION AND ACCEPTANCE**

- A. Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last 14 days is without a system or equipment malfunction.
- B. At the final inspection a factory trained representative of the manufacturer of the major equipment shall repeat the tests in Article 3.3 TESTS and those required by NFPA 72. In addition the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of a VA representative.

### **3.5 INSTRUCTION**

- A. The manufacturer's authorized representative shall provide instruction and training to the VA as follows:
  1. Six 1-hour sessions to engineering staff, security police and central attendant personnel for simple operation of the system. Two sessions at the start of installation, 2 sessions at the completion of installation and 2 sessions 3 months after the completion of installation.
  2. Four 2-hour sessions to engineering staff for detailed operation of the system. Two sessions at the completion of installation and 2 sessions 3 months after the completion of installation.
  3. Three 8-hour sessions to electrical technicians for maintaining, programming, modifying, and repairing the system at the completion of installation and one 8-hour refresher session 3 months after the completion of installation.
- B. The Contractor and/or the Systems Manufacturer's representative shall provide a typewritten "Sequence of Operation" including a trouble shooting guide of the entire system for submittal to the VA. The sequence of operation will be shown for each input in the system in a matrix format and provided in a loose leaf binder. When reading the

sequence of operation, the reader will be able to quickly and easily determine what output will occur upon activation of any input in the system. The INPUT/OUTPUT matrix format shall be as shown in Appendix A to NFPA 72.

- C. Furnish the services of a competent instructor for instructing personnel in the programming requirements necessary for system expansion. Such programming shall include addition or deletion of devices, zones, indicating circuits and printer/display text.

#### **PART 4 - SCHEDULES**

##### **4.1 DIGITIZED VOICE MESSAGES**

- A. Digitized voice messages shall be provided for each smoke zone of Buildings. The messages shall be arranged with a 3 second alert tone, a message and a description of the fire alarm area (building number, floor, level and smoke zone). A sample of such a message is as follows:

Alert Tone

Code Red

Building One, Second Floor, East Wing

Code Red

Building One, Second Floor, East Wing

Code Red

Building One, Second Floor, East Wing

##### **4.2 LOCATION OF VOICE MESSAGES**

Upon receipt of an alarm signal from the building fire alarm system, the voice communication system shall automatically transmit a 3 second tone alert and a pre-recorded fire alarm message throughout the floor in alarm, the floor above and the floor below.

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